THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIV. No. 1625.] LONDON, JULY 3, 1894. [46TH YEAR. PRICE 6d.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works
(also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

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Special Quotations to Gas Companies.
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Lanemark Coal Co.,
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LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on application to
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Shipping Ports: All the principal Scotch Ports.

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STOCKTON-ON-TEES'
Manufacturing Gas Engineers.
See Advt. p. 4 of this week's issue.

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"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz. :—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
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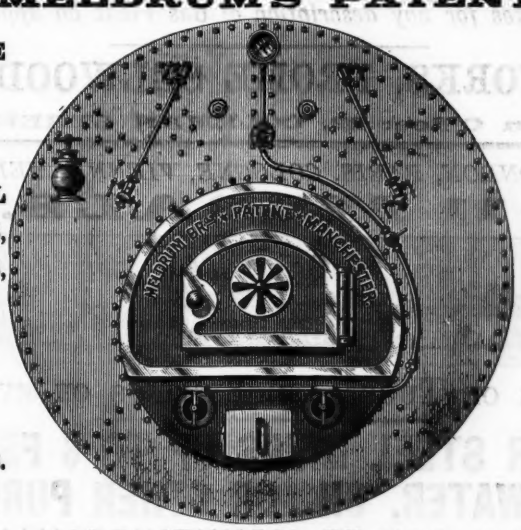

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PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

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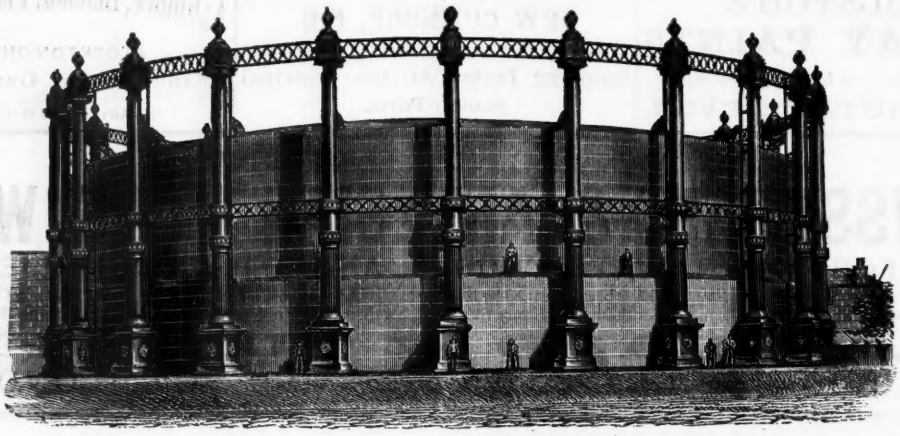

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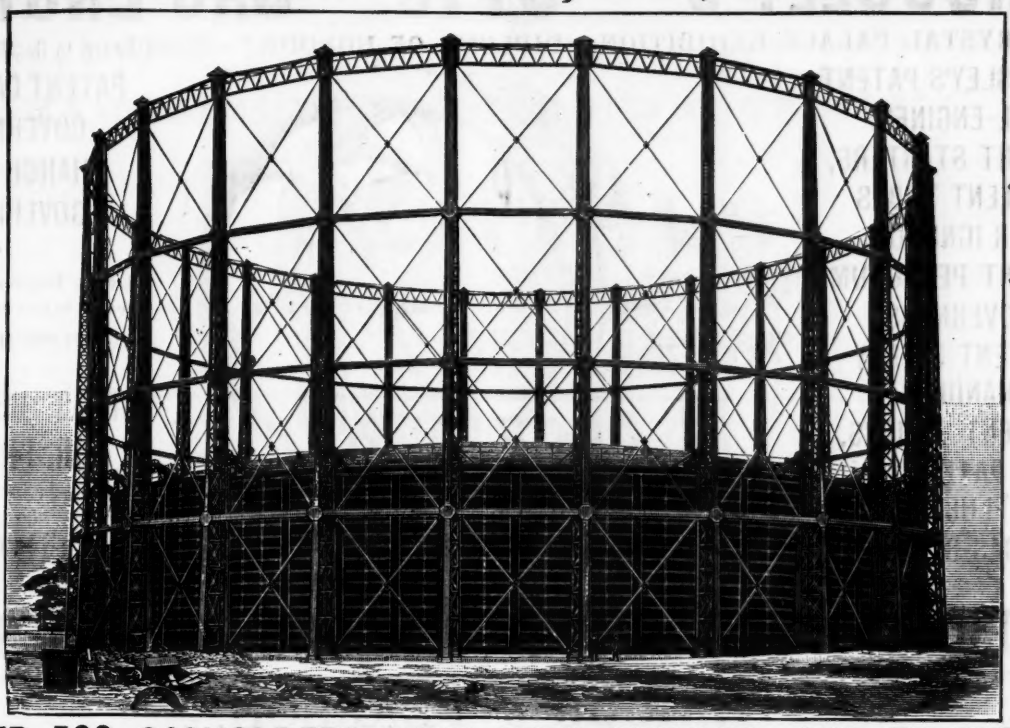

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Address THE STRAFFORD COLLIERIES COMPANY,

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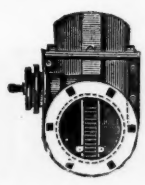

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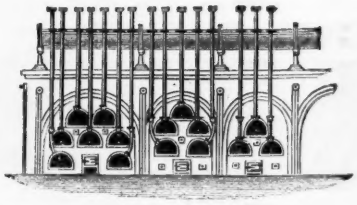

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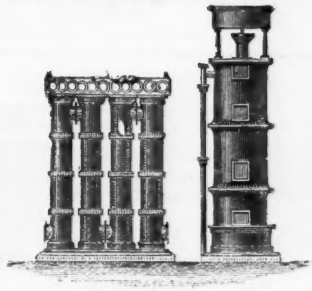

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for working Purifiers,

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PURIFIERS with Planed Joints,

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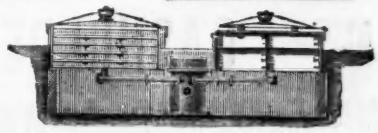

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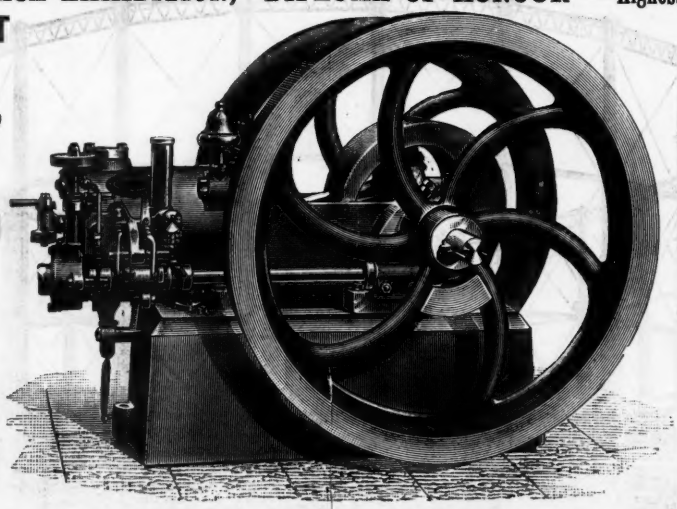

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Every Engine thoroughly tested before being sent out

ALL PARTS MADE STRICTLY TO GAUGE

GREAT REDUCTION IN PRICES.

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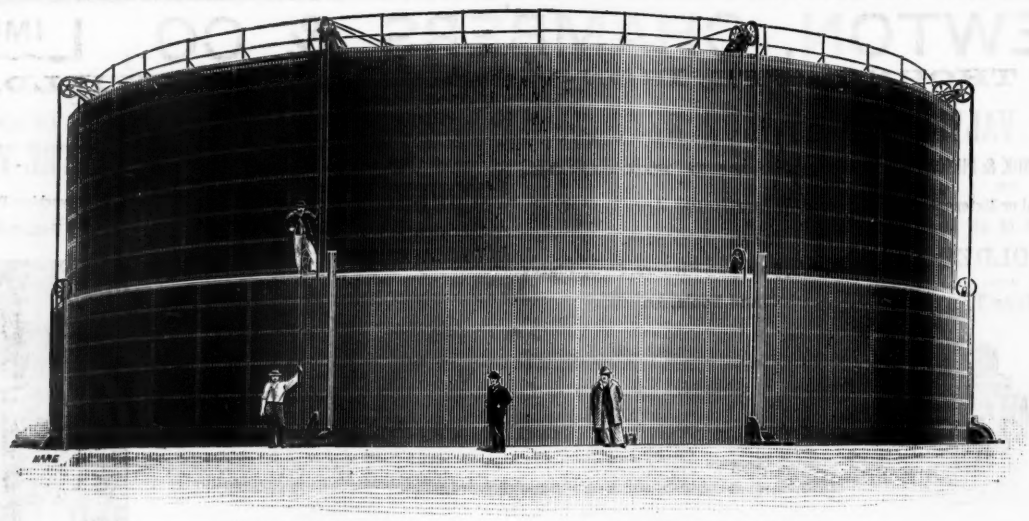

Illustration of BATHURST Holder, 82 feet diameter by 18 feet deep each Lift.

GASHOLDERS ON THE WIRE-ROPE SYSTEM

SUPPLIED TO THE FOLLOWING CORPORATIONS, COMPANIES, AND WORKS AT

MANCHESTER (4 Holders).	HASLINGDEN.	HARROGATE.	BIRKENHEAD.
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C. & W. WALKER,

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PURIFIERS with Planed Joints.

TOWER SCRUBBERS.

PURIFYING-MACHINES FOR AMMONIA.

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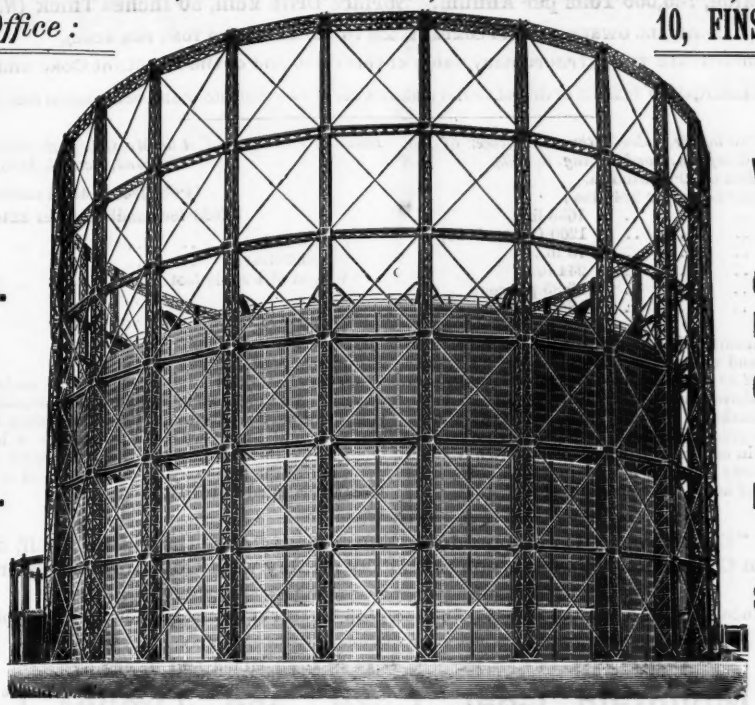
TAR PLANT.

SULPHATE OF AMMONIA PLANT.



GASHOLDERS.

WASHERS.

WASHER-SCRUBBERS.

CLAUS' SULPHUR-RECOVERY PLANT.

CENTRE & FOUR-WAY VALVES.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES, &c., &c., &c.

The above is a view of the largest Gasholder (four-lift) of The Gaslight and Coke Company, Beckton, containing 8 million cubic feet, erected by us in 1892.

Sole Makers of **WECK'S** Patent CENTRE-VALVE, & **CRIPPS'** Patent HYDRAULIC MAIN VALVE.

THE AUTOMATIC GAS-METER CO., LTD.,

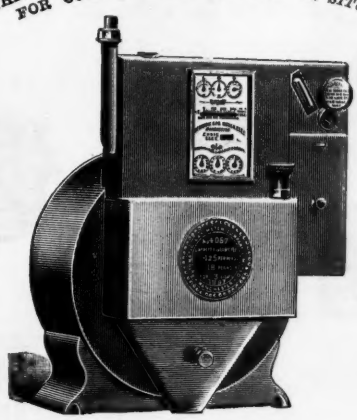
UPPER BROOK ST., MANCHESTER.

SOLE PROPRIETORS OF

THORP, MARSH, AND HAYNES' PATENTS.

PENNY-IN-THE-SLOT GAS-METERS.

THE AMOUNT OF GAS GIVEN IN EXCHANGE FOR COIN CAN BE ALTERED *IN SITU*.



The persistent efforts of the Inventors of our Meters have been crowned with

SUCCESS.

There can be no two opinions on the question of the priority of our claim to the consideration of Gas Companies as *the First* Introducers, on a Practical Scale, of a Penny-in-the-Slot Meter.

THE AMOUNT OF CASH PLACED IN THE BOX IS RECORDED. THIS IS A COMPLETE CHECK AGAINST FRAUD.

PENNY-IN-THE-SLOT GAS-METERS.

So long ago as 1889, we advertised our Penny-in-the-Slot Meters as having the now fully-recognized advantage of ability to alter IN SITU the amount of Gas given per Coin. Automatic Meters without Coin-Counting Index are liable to be tampered with.

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"BEAR CREEK"

The best **KENTUCKY CANNEL** in the Market.

Capacity of Mine, 160,000 Tons per Annum. Surface Drift Vein, 50 Inches Thick (*No Partings*).

AREA (ALL OWNED BY THIS COMPANY) 5000 TO 7000 ACRES (6000 TONS PER ACRE).

SAMPLE CARGO will demonstrate the extraordinary value of this Coal, and of the resultant Coke and other Bye-Products.

The unlimited quantity and REDUCED PRICE of this Material makes it the most satisfactory and economical Gas Enricher now available.

Result of Practical Working Test by Mr. John Methven, Engineer of The Gaslight and Coke Company, London, Aug. 8, 1893.

16·159 feet of 29·56 candles.
(484·770 candle-feet per 2240 lbs.)

Sperm Value	1638 lbs.
Specific Gravity	1200 (Water 1000)
Weight of 1 cubic foot	75 lbs.
Coke	944 lbs.
Carbon in Coke	80·83 per cent.
Ash „ „	18·43 per cent.

Remarks by Mr. Methven—

"Sample received representing full section of working in mine. The whole sample was broken up and well mixed; and the practical results obtained represent the mean of 18 experiments. *The general results may be considered reliable.* The above results stamp this Cannel as being one of the most valuable obtainable. Not only does it possess a high yield of very rich gas, but its production of coke is of large quantity, and of a quality rarely found in cannels producing such a rich volume of gas. The coke is eminently suitable for mixing with coke from common coal; its percentage of ash being remarkably low."

Result of Laboratory Test by Mr. George R. Hislop, Gas Engineer, Paisley Scotland, Oct. 26, 1893.

14·630 feet of 41·24 candles.
(603·488 candle-feet per 2240 lbs.)

Sperm Value	2069 lbs.
Specific Gravity	1152 (Water 1000)
Weight of 1 cubic foot	72 lbs.
Coke	994 lbs.
Carbon in Coke	92·30 per cent.
Ash „ „	7·70 per cent.

Remarks by Mr. Hislop—

"Very compact and cohesive, and uniform in composition and density. A cannel coal of exceptional value, and remarkable light-giving power and purity, affording a light and spongy coke of excellent quality. The Coal contains a very small percentage of both water and sulphur. Compared with Main Lesmahagow represented by 100, having regard to the value of the secondary products and cost of purification of the gas, this Coal is equal to 137·11."

COKE.—Briefly the "Bear Creek" Cannel produces a first-class Coke—that is, by itself, and unmixed with Coke from Common Coals—merchantable, comparing favourably with Coke from the Standard Gas Coals.

Correspondence solicited. Printed Reports, Analyses, and Letters of Commendation sent on application.

"BEAR-CREEK" CANNEL Mined and Owned by

The Log Mountain Coal, Coke, and Timber Company,

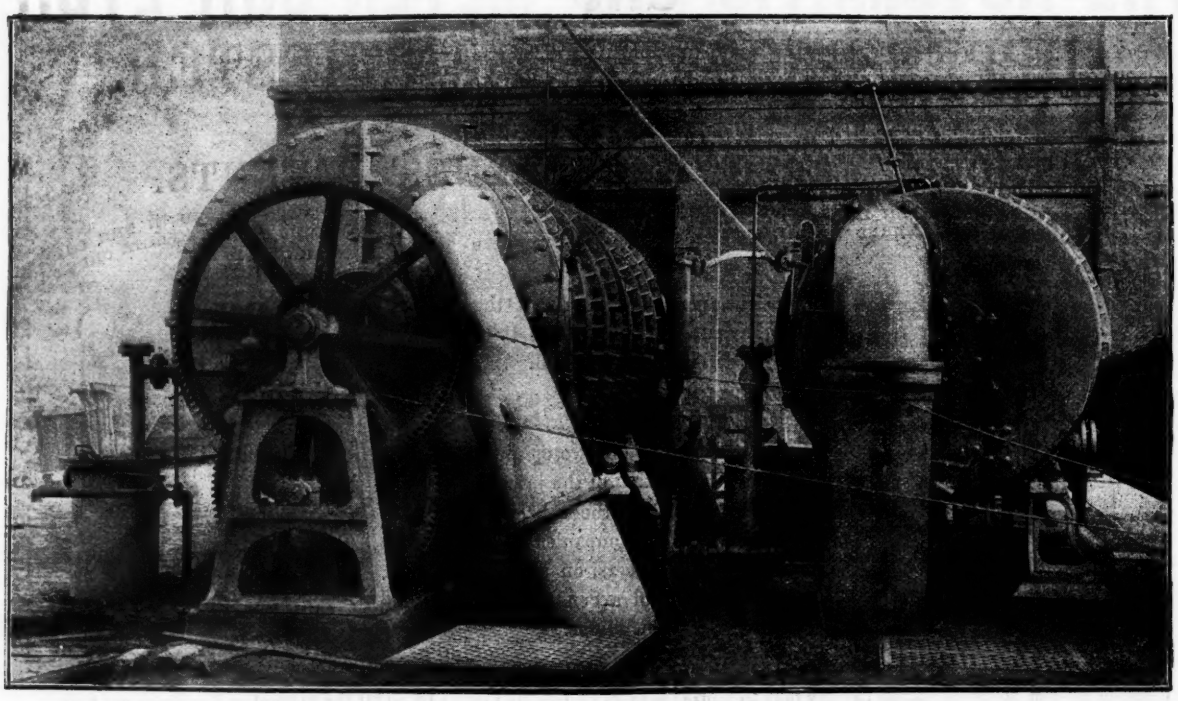
PINEVILLE, KENTUCKY, U.S.A.

Cable Address: "HULL, PINEVILLE" (A.B.C. Code.)

NOTE.—The President of the above Company (Mr. F. A. Hull) is now in Europe; and Letters or Telegrams addressed to him care of Low's Exchange, 57, Charing Cross, London, until July 11, will receive prompt attention.

W. C. HOLMES & CO.,

CONTRACTORS, AND MANUFACTURERS OF GAS AND CHEMICAL PLANT.



IMPROVED PATENT SCRUBBER-WASHER as erected for the Corporation of Glasgow, and many other Corporations & Gas Companies, &c.

These Washers are guaranteed to present a larger area of wetted surface (size for size) to the action of the Gas than those of any other maker. Results are unapproached by any other system. References and full Particulars on application.

MAKERS OF GASHOLDERS OF ALL SIZES, AND GAS AND CHEMICAL PLANT GENERALLY.

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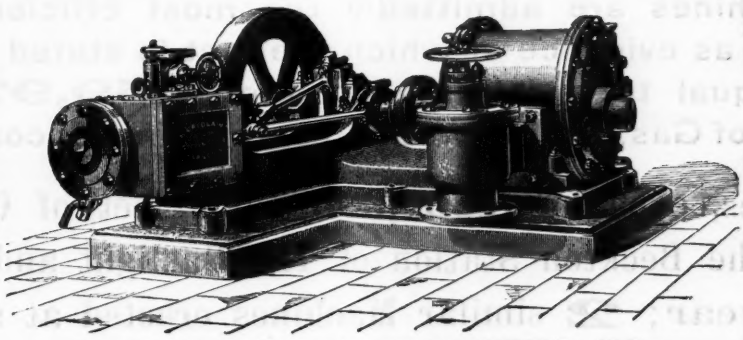
GAS AND WATER ENGINEERS.

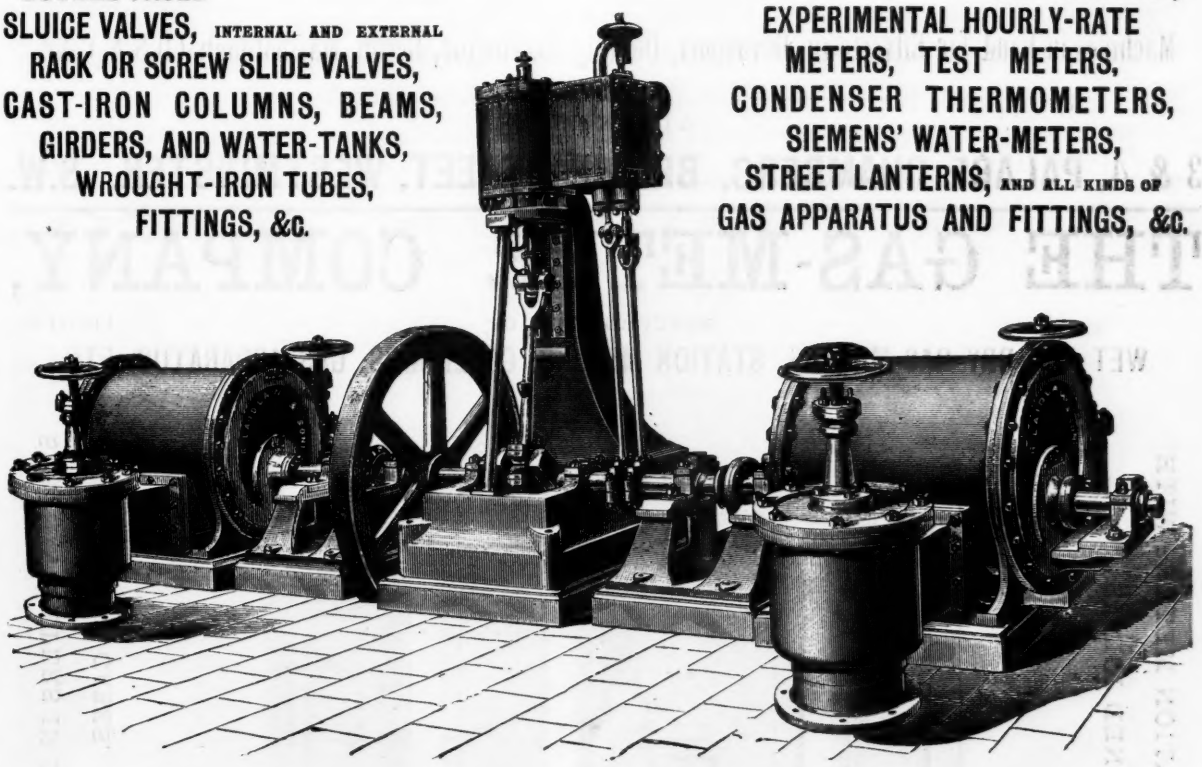
Manufacturers of **GAS APPARATUS** of every Description.

Makers in Glasgow of
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING-ENGINES For Water-Works.
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES, INTERNAL AND EXTERNAL
RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS, BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



BEALE'S GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.

Makers in Edinburgh of
WET AND DRY GAS-METERS, IMPROVED
STATION GOVERNORS,
PRESSURE REGISTERS
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS, TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS, AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,
INTERNATIONAL EXHIBITION, EDINBURGH 1886.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

KIRKHAM, HULETT, & CHANDLER'S,

PATENT LIMITED,

"STANDARD" WASHER-SCRUBBERS

These Machines are admittedly the most efficient of any in the Market, as evidence of which the fact is stated that 476 of them, equal to a daily capacity of 459,972,000 cubic feet of Gas, are in operation or in course of construction.

4 Machines, each for 3,500,000 cubic feet of Gas per day, erected at the Beckton Station of The Gaslight and Coke Company last year; 2 similar Machines erected at same Works this year.

Machines in hand for Silvertown, Devonport, Dorking, Accrington, Berlin, Marlborough (U.S.A.), &c.

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THE GAS-METER COMPANY,

MANUFACTURERS OF LIMITED,

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.

STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, Late WEST & GREGSON. Established 1820.

For Prices and Particulars apply to

R. L. ANDREWS, General Manager.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

(See Advertisement on back of Wrapper.

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INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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J. & H. ROBUS,

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furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *Erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,

INCLUDING

MAIN LAYING

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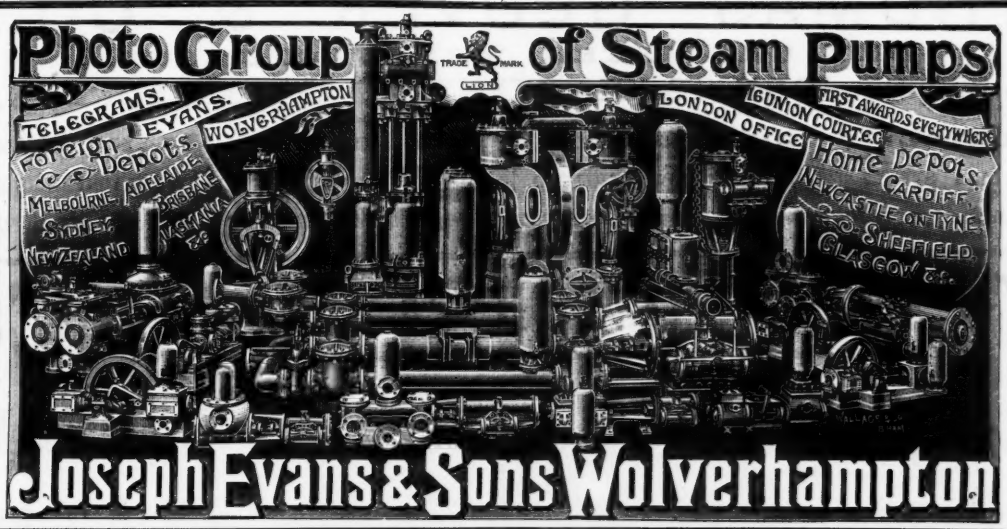
GAS AND TAR WORKS PUMPS
A SPECIALITY.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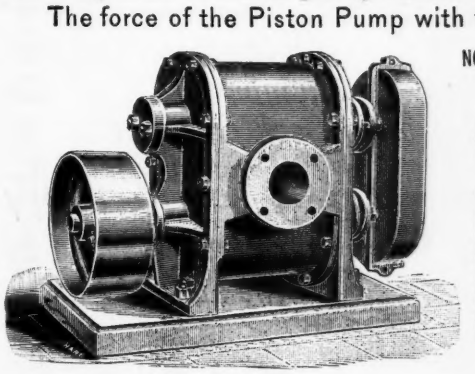

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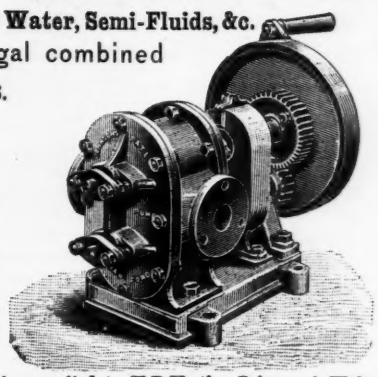

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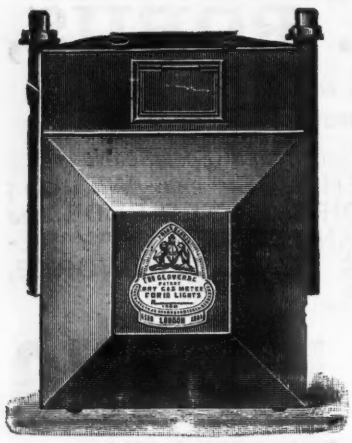

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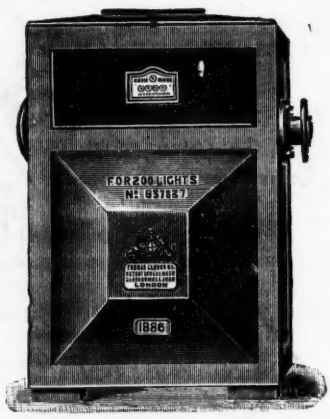

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 3, 1894.

The Case for Low-Grade Gas Restated.

IN another part of the present issue of the JOURNAL will be found a second instalment of the papers read at the recent meeting of The Gas Institute, with the report of the discussions upon the first three of the papers, published last week. As we have already had occasion to observe, Mr. Newbigging's paper was suggestive rather than conclusive; and while it is to be taken as a fuller statement of the opinions expressed by the author in his evidence upon the Plymouth and Stonehouse Gas Bill, the only scientific point in it is that of the distinction between the intensity and the diffusive power of artificial lights. We know that photometry is the practical application, to the comparison of one light-source with another, of the law of radiation, which tells us that the radiant effect varies inversely with the square of the distance. So far there is no getting away from the conclusion enunciated by Mr. Sugg—namely, that "illuminating power must be the power of giving "illumination." Yet Mr. Sugg himself was obliged to talk of the high intensity but small "volume" of the light of the electric arc. Now, what does this word "volume" mean in this connection? Is there another quality of light besides intensity and colour; and is this quality fitly described by Mr. Sugg's term? We doubt it; indeed, it is inconceivable that the science of optics would have been oblivious of such a consideration in regard to light and lighting, if it had existed. There is a way out of the difficulty, which avoids the uncomplimentary imputation of unscientific utterance that might otherwise have to be fastened upon both Mr. Newbigging and Mr. Sugg; and it lies in the suspicion that the law of squares may not cover the last word that is to be said about lights and lighting, when the source of radiation is not a point, which the law requires it to be. There is another aspect of the matter, which is that the terms "light" and "lighting" refer to different functions of the visual faculty. The illustration of the stars shows that a source of light may be easily perceived by the eye, even when it possesses no describable magnitude; for the fixed stars are as nearly perfect representations of mathematical points as we can conceive of as capable of appealing to our sense of vision. On the other hand, the best lighting is obtained when the source of light is not really in evidence, and when the nearest possible approach to uniformity of illumination is secured. The electric arc light, which is the closest artificial approach to a luminous point, also furnishes, in the system of lighting by reflection from an illuminated ceiling (the arc itself being shaded from sight), one of the best examples of uniform diffusion. The practical question, therefore, arises whether it is not a mistake to speak, according to the theory of radiation, of a portion of light as lost, in process of reflection or refraction through globes, &c., when these latter are used with a view to obtain improved diffusion. The physiological effect which is studiously avoided in photometry, when the operator is careful never to expose his eyes to the full glare of the lights he is comparing, is, moreover, one of the principal factors in the production of the general effects of lighting. In a street, in a shop, or in an apartment, the eye takes in at one view both the lights and the lighted, with the natural consequence that the more dazzling the former, the less power has the organ of perceiving the latter. It is evident, therefore, that before photometry can be credited with the power to indicate all the effects of lighting, the photometrist must come out of his dark-room, and adapt his methods to the appreciation of the relations of illumination to visual acuity. In this direction lies the solution of Mr. Newbigging's puzzle. He has not uttered nonsense in avowing his preference for the larger flame of low-power gas; but they are pedants who talk as though the carefully-screened photometer in its blackened cell comprehended all the elements that go to constitute the perfect lighting of a ballroom, a workshop, or a public thoroughfare.

Mr. Corbet Woodall combated Mr. Newbigging's advocacy of low-grade gas, while Mr. George Livesey, who was unable to be present at the meeting, gave his support to it. Mr. Woodall's argument was the familiar one "made "in America"—that a brilliant gas is needed to combat the incandescent electric light. Surely, however, Mr. Woodall and those who use the same plea for high-power gas are guilty here of confusing illuminating power with lighting effect. He must realize the fact that, in the great majority of towns, high-power gas means high-priced gas; and that where the latter condition obtains, the average consumer will stint his consumption and starve his burners, as is done in Edinburgh, where, as Mr. R. Mitchell stated, the public lamps are rated for the magnificent show of $1\frac{3}{4}$ cubic feet per hour. Again, is not the incandescent gas-burner the greatest of all rivals of the incandescent electric lamp? and is it not also an essentially low-grade-gas burner? The truth of the matter is that good lighting effect

is not to be had without free, and even lavish, gas consumption, or at least not without plenty of burners, even though these be of the brilliant incandescent or albo-carbon types, which latter the high-power cannel gases most nearly resemble in illuminating capability. The great difference lies in the circumstance that the albo-carbon burners, with their brilliant clusters, are employed to give a bright effect of lighting; whereas the costly high-power gases are only burnt by the economical consumers to "make darkness "visible" by their puny, sadly-begrudged flames. Both incandescent and albo-carbon burners will fail if they are employed in a miserly spirit—one for replacing several flat-flame burners, in the same way that sparse arc lamps are made to do a sickly duty in some of our streets. This is the secret of the brilliancy of the gas lighting of Paris, which strikes everybody, and shocks a pedantic photometrist when he is made to realize that the gas which produces such an effect is only of about 13-candle power. Parisians like plenty of light; and, in order to get it in the places where they mostly congregate after nightfall, they use multitudinous lights. It is difficult to accept Mr. Sugg's view that the effect in question is due to the superior carefulness of the Parisians in the use of their gas, as compared with the people of many English and Scotch towns. It is more reasonable to think that the result is a natural consequence of the different temperament and social customs of the people. England is an early-closing land; and this, although conducive to the well-being of a the people, does not tend to make our streets look lively at night. Then we have no outdoor *cafés;* and, generally speaking, we do not live in the streets, even of London. Hence it is easy to fall into misconception of the kind of evidence that Paris has to supply of the advantages of a low-grade gas. All the same, while Paris and Edinburgh retain their respective styles of street lighting, advocates of high-power gas will be sorely put to it to make good their case.

The Field of Technical Journalism.

One of our technical contemporaries, recently discussing the failure of the Chicago Exhibition, remarked that the time is past when these shows furnished engineers and mechanicians with the means of that early publicity which is the surest way of taking the market. It went on to point out that now-a-days it is the technical periodical which best subserves this purpose. Business men with novelties to push cannot afford to wait for infrequent exhibitions to make their goods known; but any week the special organ of their trade is open to them, and brings their productions straight under the notice of the very persons who are most interested in such matters. And even when a firm has a position to maintain, rather than a trade to create, the object can be achieved through the same means of publicity. Yet more recently, another contemporary, discussing the work done by scientific and technical institutions in educating students, observed that evidence of having acquired the habit of regularly reading scientific and technical journals should be as good a proof that the student is working, as a register of attendance at meetings. These statements, albeit open to the criticism of emanating from interested witnesses, are nevertheless worthy of attention. It cannot have escaped the observation of thoughtful people that the idea of grand international exhibitions has no longer any charm for English manufacturers, or for the English public either; and it is equally obvious that such gatherings as those of the British Association have lost much of their more solid kind of attraction. The reason for both results is essentially the same. The modern *desideratum* in regard to publicity is promptness. We cannot afford to hoard our surprises for a whole year, to say nothing of from year to year, or from one international exhibition to another. The modern man of science and the modern technician must make his sensation quickly, if he is to make it at all For all he knows, a score of other workers may be thinking his thoughts, devising his patterns, repeating in their own experience his successes while yet he is hesitating as to the means whereby he can establish his own priority. Thus it is that he cannot wait even for a meeting of a scientific or technical society before hanging out his sign in the eyes of his contemporaries. These things do come before the societies, and they also enter into the programmes of exhibitions; but rarely as novelties. News of them has been promulgated before; and it is merely the more deliberate presentment of that in which a certain amount of interest has already been created by journalistic notices which engages the society and the exhibition frequenting public.

Many people fully realize this state of things, and consequently never omit to glance through the periodicals connected with their professional or trade interest, nor delay in publishing anything they may have to communicate to the technical world. These are the men in the forefront, who are renowned among their fellows as those who know things, and are thoroughly up to the time of day. Others there are who affect to despise periodical literature, and flatter themselves that the whole of contemporary knowledge in their particular line resides in their own inner consciousness. These may be regarded as the dummies, the mere placemen and figure-heads of their profession or calling, who collapse like pricked bladders when some sardonic opponent gets home upon them through their coat of vanity and self-conceit. We have in the gas industry a sufficient proportion of these hangers-on—men who have had fathers before them, or have been sufficiently lucky to ride into prosperity on a fortunate wave. It is, of course, too much trouble for them to read the Journal, even if they could bring themselves to admit that our pages occasionally contain scraps of information which they do not possess, and cannot find elsewhere. Yet now and again, when some troublesome town councillor "wants "to know, you know," and will not be put off, or when a new director requires a bit of special coaching, these are the very gentlemen who cause us amusement with urgent queries as to what is known of some technical question which has been discussed up and down in these columns for months and years. Our correspondents occasionally complain to us of the brain-sucking to which they are subjected by the inquiry-circular. But it is quite as irritating, and more disheartening, when the Editor of the Journal is made the recipient of a curt demand for information as to whether the profit-sharing system has ever been tried in gas-works, or is asked where information respecting cannel substitutes may be obtained! And this sort of know-nothingness is manifested, be it remembered, not by outsiders who might legitimately plead ignorance, but by well-placed men, who might reasonably be expected to have cultivated their vision by observation of matters slightly removed beyond the end of their own nose. This is the kind of blundering that gives occasion to the scoffers to accuse gas managers of being narcotized by the security of their employers' dividends.

The Annual Report of the Manchester Gas Committee.

The annual report of the Gas and Electric Light Committee of the Manchester Corporation has been issued; and it will be considered by the City Council to-morrow. The principal statements and figures of the report will be found in another column. There has been a decrease of 2·82 per cent. in the total consumption of gas, though the number of consumers has slightly increased, and the popularity of gas fires, cooking-stoves, and engines is steadily growing. The revenue account for the year has been sadly interfered with by the coal strike, which rendered necessary an extra expenditure of £44,562, and consequently brought down the net profit to £30,589. As the Committee were required to subsidize the city fund in the amount of £64,321, they have had to take the balance of £33,731 from the contingent fund. This is practically equivalent to paying from this reserve two-thirds of the extraordinary expenditure for coal. The Committee admit having had trouble with their new gasholder tank at Gaythorn, which has necessitated their calling in additional professional advice; but the remainder of their structural work appears to be going on satisfactorily. With regard to the electric lighting department, it is reported that the works were started at the end of last July, so that there has been a winter's experience to record. At the close of the municipal year, the number of consumers was 412, and £127,374 has been spent upon the undertaking, from which a revenue of £10,067 was derived, which works out to 5½d. per unit. The working expenses amounted to £5509; but when the capital charges are added, the account shows a debit balance of £209 to be carried forward. The demand for current is stated to be increasing; and accordingly the station is to be enlarged. The report, as a whole, is a colourless and non-contentious composition, raising no questions of policy. In face of the trouble with the coal supply, there

is not likely to be a recrudescence of the demand for a reduction in the price of gas; and we shall note with interest whether anything is said at the Council meeting on the vexed question of administration. The improvement of the works and plant appears to be progressing steadily, while some of the defects of the distribution system are being remedied. The ratepayers are to be congratulated upon the fact of the electric lighting undertaking having almost paid its way during the first nine months' working. But, of course, the cream of the district has been taken to commence with; and the further progress of capital outlay will need careful watching—an open capital account being one of the weaknesses of undertakings of the kind everywhere.

The Gas Affairs of Plymouth.

Against the advice of Mr. Corbet Woodall, and by the narrow majority of a vote of 13 to 12, with 10 abstentions, the Plymouth Town Council have declined to approach the House of Lords with a request for the insertion of a purchase clause in the Plymouth and Stonehouse Company's Bill. Indeed, they have gone further, and have withdrawn the opposition in the Lords of which notice had been given. This is so far good; but we must admit the wisdom of Mr. Woodall's suggestion in the interest of the Municipality. With regard to the interest of the consumers, the case is different; for it is difficult to perceive how they could be benefited by a transfer of the undertaking to other hands than those which have hitherto worked so well for all the parties concerned. This consideration, in conjunction with the inevitable electric light bogey, moved the majority of the town councillors, who decided that the town had better not take any steps leading to the acquisition of the gas undertaking. Another such opportunity will not offer itself for some years; and a good many things may happen in the meantime. But we do not believe the people of the great western seaport will ever regret having left the gas supply in the accustomed hands. Nor do we believe that the slightest fear need be entertained for the future of a gas undertaking conditioned as is this of Plymouth, whether owned publicly or privately. The Company renew their constitution by this year's Bill, which will shortly become law; and there is every reason for holding that the undertaking will do better than ever under the new enactment.

Professor Lewes on Low-Grade Gas.

In the issue of *Nature* for the 21st ult., Professor Vivian B. Lewes has an article upon the "Enrichment of Coal Gas," which is, in the main, a *résumé* of his last Society of Arts paper on the subject, which has gained for him one of the Society's silver medals. It concludes, however, with a strengthening of the author's position with regard to the uselessness, from the point of view of the consumer, of artificial enrichment as applied to ordinary coal gas, which Professor Lewes now declares to be of value solely for satisfying the legal requirements. Referring to the recent South Metropolitan experiment of sending out unenriched gas for a fortnight, it is stated that tests made with portable photometers on consumers' premises gave identical results before, during, and after this period; thus clearly showing that the consumer gains absolutely nothing in return for what enrichment costs him. Professor Lewes argues that, though it is to the interest of the gas consumer and the gas company alike that the price of gas should be reduced to the lowest possible figure, this desirable end is frustrated by the mistaken legal requirements. His conclusion, therefore, is that "a minimum of "illuminating value should be fixed for each town, based "upon the coal used, and any fall below this should be "visited by a fine of £50 for the first half candle, and an "increment of £100 for each half candle below that; while "the price charged for the gas should be governed by its "illuminating value for the quarter, as averaged from the "testing-station returns—a low initial price (say, 2s. 2d. "per 1000 cubic feet) being charged for 14-candle gas, "and 1½d. a candle for each candle, with a maximum price "of 2s. 5d." If some such arrangement as this could be adopted, not only would the gas consumer, in Professor Lewes's opinion, obtain the full value for his money, but the Gas Companies would reap the benefit of an enormous increased consumption for fuel purposes; and the atmosphere of our big cities would gain in proportion. It is known that Professor Lewes is practically in accord with Mr. George Livesey upon this head; and the latter has made it clear that, in his judgment, the initial price of gas depends on the quality. That is to say, Mr. Livesey regards the project for the abandonment of enrichment as a matter for the gas consumers; and he does not desire that the Gas Companies should take any immediate share of the economy to be gained in this way in the form of increase of dividend. Where the profit of the Companies would come in would, of course, be in the higher rate of increase of gas consumption; but this would be merely the natural commercial advantage incidental to the growth of the business.

WATER AND SANITARY AFFAIRS.

The somewhat qualified doubt expressed by Sir W. H. Wyatt at the recent meeting of the Chelsea Water Company, as to whether the Thames Conservancy Bill would get through Parliament in the face of the opposition presented by the London County Council, appears fully justified by the subsequent course of events. In the House of Commons on Thursday, Mr. Stuart moved the recommittal of the Bill, and proposed that it be an instruction to the Committee to add four members to the Board of Conservators, beyond the number authorized by the Bill as it stands. Further, Mr. Stuart moved that the Committee should so amend the Bill that the constitution of the Board of Conservancy should terminate on Dec. 31, 1896, unless continued by Act of Parliament. The discussion which followed was interesting, as showing the position taken up by the County Council; but Mr. Stuart was met by the difficulty that the motion for the recommittal and the proposed instruction could not be taken together. The Speaker explained that the objection was a technical one; and it involved so slight a breach of order, that he suggested it might be overlooked on a future day. To this suggestion all parties agreed; and the debate now stands adjourned until next Tuesday, when all Mr. Stuart's proposals will be laid before the House "by order." The point raised on behalf of the County Council is that "London" will not be properly represented on the new Board. The Bill provides that the Corporation and the County Council shall each have four members. Mr. Stuart proposes that each shall have six. If so, we presume the total number of members must be raised from 33 to 37. But it may be asked whether this is really all that the County Council contemplate. Mr. Stuart explains that the object of his friends is not to overthrow the Bill, but to amend the constitution of the Conservancy Board. Yet if this is the whole of the design, why the terminating period? This, we are told, is intended to ensure that proper inquiry should be made into the whole question of the representation on the Board. It is perfectly clear that the Bill has taken a shape which does not much please the County Council; and Mr. Stuart virtually acknowledged this when he stated that, during the progress of the Bill through Committee, changes had been made in a contrary direction to that desired by the Council. The attitude of the Government on this subject is indicated by the remarks made by the President of the Board of Trade, last Wednesday, in receiving an important deputation urging the Government to oppose the motion of the Council for the recommittal of the Bill. The reply given by Mr. Bryce showed no intention of resisting the Council, but rather an idea of reopening the whole question by referring it to a Hybrid Committee. Discredit was thrown on the deliberations of the Select Committee presided over by Mr. Jackson, as emanating from a body too small to investigate so large a question. Much that Mr. Bryce said sounded like an echo from Spring Gardens. On the whole, there seems some risk that 28 days and £25,000 will have been thrown away by the recent inquiry on the subject.

Lord Balfour of Burleigh appears to be afraid that the recommendations of the Royal Commission on Metropolitan Water Supply, with which he is identified, will not be duly respected by the Legislature. The East London, the Southwark and Vauxhall, and the West Middlesex Water Bills having been read a second time in the House of Lords last Friday, Lord Balfour moved that it be an instruction to the Committee to which these Bills shall be referred, not to proceed with any clauses which would interfere with the arrangement of a comprehensive scheme for increasing the water supply of the Metropolitan district "on the lines "indicated in the report of the Royal Commission presented "last year." His Lordship's argument was that nothing more should be authorized at present than was absolutely

necessary. Concerning the Bill of the Southwark and Vauxhall Company, Lord Balfour feared that, if it were passed in its entirety, the Company would not be likely by-and-bye to join in any comprehensive scheme which might be promoted by other Companies. Does his Lordship expect the Staines project to be completed? "The "comprehensive scheme shadowed forth by the Commis- "sion" was mentioned by Lord Balfour as likely to be carried through at some future date. Among the big questions coming on, his Lordship alluded to the County Council's scheme for acquiring the undertakings of the Companies. He might have added something about Wales —a project to which he would be likely to object somewhat strongly. The Earl of Morley offered sundry sensible remarks on the subject, calculated to allay Lord Balfour's apprehensions, and was followed by the Marquis of Salisbury. In deference to the views thus set forth, the proposed instruction was not pressed. The main consideration is that London wants water; and it is to be hoped that this fact will not be overlooked amid the multitude of arguments. The Water Committee of the County Council now propose that eight separate Bills shall be prepared for the acquisition by the Council of the undertakings of the eight Metropolitan Water Companies. The recommendation is on the Council's *agenda* for to-day as "urgent."

Mr. J. Wilkinson, of Pudsey, has been appointed Consulting Engineer to the Calverley and Horsforth Gas Company.

The Chairmanship of the Manchester Gas Committee.—Mr. Alderman R. Gibson, who has hitherto acted as Deputy-Chairman of the Manchester Corporation Gas Committee, has been appointed Chairman, in succession to the late Mr. J. Brooks. Mr. Alderman Higginbottom has, at the same time, been elected Deputy-Chairman.

The Carriage, Storeage, and Sale of Petroleum.—In the House of Commons last Friday, a Select Committee was appointed to inquire into and report upon the law relating to the keeping, selling, and conveyance of petroleum and other inflammable liquids, including the precautions to be adopted to prevent the sale of dangerous lamps for use with inflammable liquids.

Society of Arts.—The Council of this Society have awarded silver medals to Professor Vivian B. Lewes, F.I.C., F.C.S., and Mr. W. Worby Beaumont, for their papers on "London Coal Gas and its Enrichment" and "The Automatic Balance of Reciprocating Machinery and the Prevention of Vibration," read during the past session, and noticed in the JOURNAL. The new members of Council for the current year are Lord Belhaven, Captain Abney, Mr. J. Wolfe Barry, C.B., and Mr. A. Siemens.

Presentation to Mr. G. Wilson, of Lewes.—The recent resignation by Mr. George Wilson of his position as Manager of the Lewes Gas-Works, was taken advantage of by the members of the Pelham Lodge of Freemasons No. 1303 (of which lodge Mr. Wilson is a P.M.), to show their appreciation of the esteem in which he is held by them "as a man, a friend, and a mason," by inviting him to a dinner at the Royal Oak Assembly Rooms, Lewes, on last Friday week. At the close of the dinner, Mr. Wilson was presented with a gold keyless watch, bearing the following inscription: "Presented to Bro. G. Wilson, P.M., 1303, 1619, P. Prov. G. Stnd. B., Sussex, by the members of the Pelham Lodge, No. 1303, as a mark of fraternal esteem."

The Effect of Lead Pipes on Water.—In a recent number of the *Chemiker Zeitung*, M. Lecco described some tests made with the new water supply of Belgrade. The water contains iron, calcium, and magnesium salts, is of 24·8° total hardness (German scale), and holds in solution more than 0·5 gramme of carbon dioxide per litre. Lead was tested for in water which had stood over night in the pipes; the following method being employed: A litre of water acidified with acetic acid was evaporated down to 100 to 200 cubic centimetres, filtered, and a drop of dilute sulphuretted hydrogen water added. If lead was present, even in the most minute quantity, a darkened coloration of the water was observed. As this reaction might be partially obscured by the precipitation of the iron present in the water, it was necessary to make a test at the same time with a sample known to be free from lead. In carrying out the tests described by M. Lecco, a piece of lead pipe 7 metres in length, and 22 millimetres in diameter was employed. The solvent effect of the water on the lead was greater at first than it was after the tube had been some time in use. But even at the expiration of three months, about 0·3 milligramme of lead per litre was found in water which had stood 24 hours in the pipe. After standing three hours, a trace of lead was detected; but in water which had merely run through the pipe, no lead could be found. Therefore, where lead pipes are used, the water should be allowed to run for a few minutes before taking it for drinking purposes. The somewhat large amounts of lead dissolved by this particular water might, it was thought, be due to its richness in free carbonic acid. The author recommended that subsequent papers on this subject should include a full analysis of the water, in addition to the method adopted for estimating lead.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FIRST ANNUAL GENERAL MEETING,

HELD AT THE

WESTMINSTER TOWN HALL, JUNE 19TH, 20TH, & 21ST, 1894.

JOHN WEST, ESQ., M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

In the JOURNAL last week, we reported the general proceedings at the above meeting, and commenced the publication of the technical portion by giving the papers read by Mr. Thomas Newbigging, Mr. G. Anderson, Dr. C. B. Voisey, and Mr. J. Stelfox. We now continue our report by giving the discussions to which the first three of these communications gave rise, as well as a further instalment of papers.

DISCUSSION ON MR. NEWBIGGING'S PAPER ON "ILLUMINATING POWER AND ILLUMINATING EFFECT."

Mr. W. SUGG (London) said there were several points in the paper which made him feel somewhat as though he were "sitting on a fence." Mr. Newbigging spoke in one place of gas of 14-candle power, and in another of 15-candle gas, as being better, for the general purposes of the public, than 16 or 18 candle gas. At first he (Mr. Sugg) felt inclined to agree with him, except with regard to the range; because he thought it was better to keep to either 14 or 16—say 14—candles. Many who were present no doubt went on a memorable occasion to Paris; and looking back to that time, they would agree with him that they all thought the gas there was of a higher illuminating power than that of London, whereas, as a matter of fact, it was rarely up to 14, and was more frequently 13 candles. The fact was that a better result was obtained from the gas consumed in Paris than in many towns in Scotland and England, probably, as Mr. Newbigging had pointed out, because they burnt it more carefully; the price there being double what it was in England. But then there came in the effects of burning gas in an improper manner. If one had gas of 16, 18, or 20 candle power, or, as in some places in Scotland, of 28-candle power, one must employ proper burners in each case; and to take the same burner for all, could not give the best results. Yet this was the general practice; so that there was a very strong argument, as there seemed to be a great tendency to use one kind of burner for every quality of gas, in favour of having gas of one uniform standard, such as might be burned with greater ease than the very rich kinds. In burning rich gas, they could, no doubt, get the best illuminating power, and have less products of combustion, and less heat to produce the same light, if it were properly used; but if they took a burner fit for 16-candle gas, and had a big flame from rich gas, with insufficient oxygen, this would not give its best illuminating power, and gas must be wasted and discontent created. Mr. Newbigging spoke of illuminating power and illuminating effect as being different; but it seemed to him (Mr. Sugg) that illuminating power must be the power of giving illumination. If they had a gas which would not give sufficient illumination, either in consequence of being consumed in an improperly constructed burner or for any other reason, it was certain it had not the illuminating power in it. He did not know, therefore, that he quite understood the difference between illuminating power and illuminating effect. [Mr. NEWBIGGING: Take an electric arc light.] If an electric arc light was measured photometrically with a not too long photometer, it would be found to have a very high illuminating power; but there was no volume in it. There was high intensity, but no volume. If this light were put into a globe of frosted or some kind of obscured glass that brought down its high intensity, one would get a large volume of lower intensity; so that a better result would be obtained, though about 50 per cent. of the actual light would be lost. Perhaps this would illustrate what Mr. Newbigging meant by the "illuminating effect." Although the power

was in the lamp, one did not get the illuminating effect out of it. The same was the case with incandescent electric lamps. One often saw a large number of these, as in a room where he was on the previous evening; but there were also 42 candles, without which they would have been in a state of "dim religious light." Whether gas of low would be better than gas of high illuminating power was an extremely delicate question. The greatest number of complaints made in London as to the quality of the gas supplied were when it was higher than the standard; and he would venture to assert that, if one of the London Companies were to increase the power by 1½ or 2 candles, there would be a shoal of letters next morning complaining of the inferior quality of the gas, and describing it as being smoky and bad. If the gas were only 14-candle, it would not produce smoke, even if it were consumed badly. The quality of the gas in London was surprisingly regular; the average illuminating power at the twenty-two testing-stations being about 16·5 candles. Mr. Newbigging seemed to think they could not test the volume as well as the intensity of the flame. The latter could be tested by means of photographic appliances; and there was now a standard of light used by photographers for making their very fine plates. It was a small Argand burner used with sulphurous ether, which gave a perfectly white light, by which they could determine exactly the speed of their plates; and it seemed to him that by the same means one could determine the intensity of a gas-burner by putting one of these plates in front of it, and seeing how long it took to produce its own image. As an example of volume of light, one must look at the sun. There was an enormous volume there, and also great intensity. Some people seemed to think the electric light might possibly compete with the sun; and the dream of certain electricians was to put up, high above the ground, a lot of electric arcs which would imitate the light of the sun. But it seemed to him that this would be a very miserable effect, and altogether different from sunlight. He quite agreed with Mr. Newbigging that, by the use of gas and ventilating burners, they would get more effective and perfect light than from any other form of lighting. Gas carried with it its own power of ventilation, because it produced the heat which was useful for this purpose; and the volume of light gave the most perfect illumination they were likely to get. Even where there was no ventilation, with small rooms, by varnishing the ceilings they would last for five or six years; and any dust that collected was easily removed. Considering the general practice in burning gas, his predilection was in favour of reducing the standard instead of raising it, and using 14-candle gas more carefully.

Mr. Norton H. Humphrys (Salisbury) said the question seemed to resolve itself somewhat into a matter of unenriched compared with enriched gas. They had been accustomed to approach questions of the quality of gas as referring only to its photometric value; but they were now reminded of the fact that, if they had an intelligent jury of consumers, their views would not agree with the indications of the photometer. They knew that very often when some of their consumers went from the South of England to the North, or to Scotland, they did not find the gas any better there than at home. The question, after all, came to be one of satisfying their consumers. Possibly the photometer had been rather a drawback in this respect. It might be that they thought too much of "running the gauntlet" of the gas examiner, and not enough of what the consumers wanted. His experience had been mostly in the small towns; and he contended that, for such places, it was quite possible to make, out of ordinary Durham or Midland coal, unenriched gas of a quality that would satisfy the consumers. It was remarkable to notice how they were gradually sliding away from illuminating gas to heating gas. Formerly they talked of nothing but illuminating value. Now, however, they were called upon continually to supply gas for other purposes than for lighting—for fuel, for gas-engines, and even for producing the incandescent light, as well as other purposes for which gas of good calorific power was as suitable as one possessing higher photometric value, but no better heating qualities. The principal thing was that they had to meet the demand for cheap gas; and he agreed with the author that a gas of 14 or 15 candle power, free from carbonic acid, would satisfy the public. It was quite possible to make a gas of 15½ or 16 candles, to give a good full-bodied flame when burning 5 cubic feet an hour in the standard Argand burner, which would contain not less than 5 per cent. of hydrocarbons, judged by the test of absorption by bromine, and which would take them between naphthalene on the one hand and the deposit of oils on the other. They wanted a gas which would distribute well without causing obstruction in the pipes. With regard to the Paris gas, which was often referred to in this connection, he formed the opinion that the atmospheric conditions in that city, where the air was so much drier and clearer, made the gas look at least a candle better than it would do if it were brought over into the English climate.

Mr. C. E. Jones (Chesterfield) congratulated the author of the paper on assuming a new *rôle*. Towards the end of his paper, he said he was a warrior; and a little farther on he took up the prophetic mantle, and told them what was about to happen. He (Mr. Jones) also congratulated Mr. Newbigging upon the paper generally, which was probably combative in order that a good discussion might ensue. Many years ago, at a meeting of the Midland Association of Gas Managers, he asserted that gas of high illuminating power—anything over 16 candles—was of very little use to the enlightened British public; and he still held this opinion. For ordinary use, gas of about 15 candles was the correct thing, and seemed to give the most general satisfaction. He did not suppose it was impossible to invent a universal burner, or one which would adapt itself for different qualities of gas; but the man who would bring out such a burner would display an amount of technical ingenuity which would certainly entitle him to the Birmingham Medal. The tendency of consumers appeared to be to go back to the old illuminating power; for the cannel gas formerly supplied by the Chartered Company in London had been discontinued, and 16-candle gas substituted with advantage. In the absence of any national standard of lighting capacity, he thought Parliament was now going in the right direction in rather cutting down the high illuminating power which formerly obtained. He would not go into the question whether or not their Scotch brethren should reduce their rich gas to 15 candles, as that of enriching the poor qualities was of more practical importance. In his district, he had heard it seriously suggested that, if they used up the old hillocks —spoil heaps, slack, smudge, and all kinds of refuse which the coalowners disregarded—and employed a little oil for enrichment, they would be able to make gas for nothing, and sell it at 4s. per 1000 cubic feet. If they had to combat combinations of colliers and masters, there might be something to be said in favour of enriching the gas; but if they could command good Yorkshire, Midland, or Durham coal, it was a poor gas manager indeed who could not easily produce from it gas of 15 to 16 candle power. Whether or not the consumer would develop from it the light of only 10 or 12 candles was another question. His experience was that a consumer was more careful about the price than the quality. There was also the question of diffusion of light. Mr. Newbigging had cited the arc light as a type of what could be done in the way of intensity; and Mr. Sugg had told them that, by the use of globes, 50 per cent. of the intensity was diffused over a larger area. He thought this was the proper way in which to utilize coal gas—not always burning it with a naked flame; and if they did sacrifice a little of the intensity to get a more widely diffused effect, it was a step in the right direction. He would remind Mr. Newbigging that the Board of Trade, in their wisdom, had actually standardized the photometer at present in use, and proposed to standardize the candle, or its equivalent in pentane; and therefore he thought it was too late to attack the photometer. Whether they should drop to a low quality of coal, and enrich it with oil, or continue on the straightforward line of using honest gas-producing coal, was a question he left to the members; but his own opinion was that the latter was the proper course to adopt. They were more likely to produce uniformity in quality; and it was the variations in quality that most frequently caused complaints.

The President remarked that he had hoped to have the presence of Mr. George Livesey that afternoon. He had, however, sent a telegram to say he could not possibly be present; but he thoroughly approved of the paper.

Mr. Corbet Woodall said he was glad to have the opportunity of making a few remarks with regard to the paper. Mr. Newbigging hoped that the policy he laid

down would receive the "eager and enthusiastic" approval of the meeting. It might be that the "faith" Mr. Newbigging had now adopted would eventually secure acceptance from the gas world generally; but there were certainly reasons why it should not. He (Mr. Woodall) was rather disposed to appeal from Mr. Newbigging the heretic to Mr. Newbigging the orthodox, whom they had known for a good many years; and he hoped they would not run away after heresy, as so many people did, simply because it was heretical. It seemed to him that what the consumer required of the gas company was a certain quantity of light; and if he could get this by the combustion of a small quantity of gas of high quality, it meant the same thing to him as getting it from a large quantity of gas of low quality, with the disadvantage in the latter case that he would have had the large quantity to consume, injuriously affecting, as it would, the atmosphere of his room. He was at a loss to find a definite principle in the paper. The author quoted with approval Mr. Livesey's proposition that the illuminating power should be fixed at such a standard "as the quality of the coal available in the district will yield;" but, in previous passages, he expressed the opinion that "enrichment to any great extent, even by the use of expensive cannel or shale, is to be deprecated;" and that a wiser policy would be to reduce the illuminating value of the gas by a judicious admixture of inferior coal. They were not told that this admixture was necessarily to be an infusion of cheaper coals; but the two propositions were hardly consistent. Taking them together, he gathered that, when the illuminating power brought out by the most available coal was satisfactory from Mr. Newbigging's new point of view—say, 14, 15, or 16 candles—it should be adopted; but if the quality brought out by the coal most easily available was high, there should be an importation of poorer coal to reduce it to what he regarded as the proper standard. Again, the quality of the gas in London—16 candles—was said to be so satisfactory that complaints were very rare; and, when made, Mr. Newbigging had assured the meeting they were groundless. Was it not reasonable to conclude that, where such results were obtained, a reduction of the illuminating standard was not only not called for, but was greatly to be deprecated? Yet the paper approved an alteration of the standard to 14 or 15 candles. But was not the question really one of price? If they were able to supply the consumer with gas of high illuminating power at a cost per unit of light not greater than that of the lower quality, he maintained that the argument from the consumer's point of view was all in favour of the higher quality, and that eventually it would be so with the companies also. The cost would doubtless vary with the situation of various towns. In some cases, it was costly to obtain enriching cannels or oils; and there the gas company would be wise to adopt, and keep if possible, a low standard. But where it was possible either to obtain cannel at a low rate, or, by the use of enriching oils, to raise the quality without any considerable additional cost, he should say by all means let them give the consumer the best light they could. This was the policy now adopted throughout the country, which was recognized by the Legislature, and was, in his opinion, a wise and equitable one. A great deal had been said about the effect of burning rich gas as being a nuisance, injurious, and offensive, because of the smoke and products of combustion; but he thought this had been greatly exaggerated. He knew something of the gas lighting of Liverpool, where the gas was 20 or 21 candles; and he certainly had not heard of special complaints there of nuisance from smoke or any other fault arising from the high quality. At the same time, speaking from long experience of gas in London and the South, he could not endorse Mr. Newbigging's statement that they were in the happy position of having no complaints as to quality. Why should not gas companies accommodate themselves to the quality of gas which was best and cheapest, and see that proper burners were used? It was as easy to adapt burners to 20 and 25 candle as to 16-candle gas. It seemed to him that the proposal now made, instead of being a step forward, was decidedly a retrograde step. They were now in the position of having to meet far more competition than formerly. They had to compete with a light that was universally acknowledged to have some advantages—some very palpable advantages—over gas; one being that it caused a less amount of heat, and that it did not vitiate the atmosphere of the rooms in which it was used. To propose to meet this attractive light by reducing the quality of that which they were supplying, and decrease the lighting power, was to his mind suicidal. The right thing was to make the gas as good and as pure as they could, having due regard to cost. Of course, they could not disregard the fact that gas was now used for many purposes other than lighting. These purposes were of great value; but they still held a very secondary place, and he hoped they would long do so. If they were to throw over lighting as their chief business, they wanted a very different suggestion from that put forward by Mr. Newbigging. He could understand the alternative of manufacturing and distributing gas having little or no lighting value, but suitable, and perhaps cheaper than the gas now supplied, for applications where heat only was required, Such gas would be available for lighting when used with either of the incandescent burners. But this was not the position taken up. No one could advocate such a policy at present. They were not prepared to "throw up the sponge" with regard to lighting. To put the case mildly, gas of high illuminating power was of no less value for heating than gas of low power; and if, as he (Mr. Woodall) maintained, the reduction in quality suggested would injure the sale for lighting purposes far more than any saving in cost would compensate, the wiser course would be to keep up the quality, and let the heating applications remain in their secondary place. Gas-engines were now recognized as economical machines for multitudes of applications; and 1d. or 2d. per 1000 cubic feet in the price of gas would not seriously affect their adoption. Some time ago, he had occasion to make an investigation in Liverpool with regard to the number of applications of gas power for various purposes, as compared with similar districts in London and Manchester; and he found that in Liverpool the number of gas-engines employed was very much greater, in proportion to steam and other powers, than either in London or in Manchester. He did not mean to say that this was because the gas was of high quality; but it did show that the comparatively higher price for this high-quality gas had no deterrent influence on people who desired to use gas for power. This question was made easier of settlement by what had been done recently with regard to carburetted water gas. The results obtained in London and elsewhere were such as to make one look with perfect equanimity not simply to the maintenance of the present average value, but to its increase. He had had the advantage of seeing a great deal of what had been done in this way since the introduction of water gas; and he was of opinion that no innovation of so great promise to the gas industry had presented itself in the years of his experience, especially because of the improvement effected in the illuminating value and quality of the gas-flame. They would hear much, he understood, in the course of the meeting, as to the cost of enrichment by this method; but, referring to the observations as to smoke, he could speak of gas of 25-candle power and upwards burning with a clear white light, and with no more smoke than they were accustomed to from London gas of 16-candle power.

Mr. W. Carr said he thought the essence of the paper lay in the sentence towards the close: "The necessity for cheap gas is of the first importance in these days of competition." When this necessity was fully understood and acted upon, he had no doubt the plan suggested could be adopted. It would enable one town to compete and compare with another, if they were all pretty much on the same lines. Generally speaking, gas of 15 to 16 candle power could be made from the coal available in this country without enrichment. He did not think there need be any great difficulty in making such gas from South Yorkshire or South Lancashire coal; and very likely, if it were carefully selected, from coal from the Durham district as well. The high-quality gas in northern towns was a thing often referred to. But on the previous evening, he observed the lighting in the different shops; and, coming from the Manchester district, where they were told the gas was of 19 or 20 candle power, he had a sort of misgiving that the gas in London must be very much better than 16 candles, or the gas in Manchester very much worse than was stated. Certainly, they seemed to get as good an effect in lighting from 16-candle gas in London as they did in the North from 20-candle gas. He would go even further, and say that they had a better light; for he

did not know of any places in the North which were so well lighted as London appeared to be. This led him to the conclusion that there must be some doubt about the gas. The one thing in Mr. Newbigging's paper which pleased him most was the fact that he discussed this question more from the consumers' point of view than any other; and as he (Mr. Carr) happened to be a consumer, pure and simple, at the present time, he had a strong inclination towards this view of the question. There was one disadvantage it would entail on some towns in the North. Whenever a gas undertaking, particularly of a corporation, was not doing well financially, it was generally said that they were making a better quality of gas. Up to now they had always satisfied consumers and the public that this was the case; but the consumers had no guarantee of it. The authorities proclaimed it; and it was believed. But the present paper evidently would take away this advantage; and some of them would be left rather stranded. He had recently noticed in the JOURNAL OF GAS LIGHTING that a public authority was asked why the gas was not made so cheaply as formerly; and the answer given was because they preferred to make it better. The consumers did not think it was any better; but they were told that it was, and they had to be satisfied with the explanation. He agreed, to some extent, with Mr. Woodall, that it was not advisable to make gas any worse; but when they could get such good effects as he had seen produced from the London gas, there was no need for any higher quality. It was nonsense to incur great extra expense in making 19-candle gas, when such good illuminating effect could be obtained from 16-candle gas. He had nothing to say about the Scotch gas. Perhaps it would cost them as much to make 16-candle as it would 20-candle gas, if they had to send to England for special coal. All they had to do was to see, if the gas was not absolutely properly consumed, that it was consumed as well as it might be, and that they obtained the greatest value from it.

Mr. G. B. IRONS (Gosport) said the question of diffusion of light was of very great importance in dealing with the question before them. In his district, there were a large number of petroleum lamps; and there was also a very good supply of gas light, besides the electric light. He found that the arc light would go right through the atmosphere like the clear point of a pencil; while in the case of the oil-lighted shops, and the places where the most powerful oil-lamps were used, the diffusion of light outside, was very limited indeed, compared with the neighbouring gas-lighted shops. Taking the ordinary atmosphere, there might possibly be certain substances in the case of coal gas which the atmosphere would receive and diffuse more readily than it would do if the light came from other sources.

Mr. J. M'GILCHRIST (Dumbarton) said he was rather disappointed with the result of Mr. Newbigging's paper. The author generally made a very good job of anything he tackled; but, on the present occasion, he seemed to have nothing better to say on the question of the illuminating power of gas than "Bring it down." Of course, this was merely an opinion. Mr. Newbigging even seemed to protest against the photometer, and to suggest that it did not give the true value of the illuminating power of a gas. This appeared very strange coming from him. One would think, from the paper, that there was merit in having low-quality gas; and that, if they had a better quality, they should bring it down. But this was quite contrary to the spirit of the age. It was light that people wanted, not gas. When Mr. Carr referred to the lighting effect of London gas, he left out of consideration the quantity that was being burnt to produce it. If they could supply the consumer with gas that would be cheaper per unit of light, and it was of 40-candle power, it would be on the right lines, because the higher the quality, the less injury was done to the atmosphere of a room. Mr. Newbigging had not shown any reason for reducing the quality. Perhaps in the South of England it would be cheaper, per unit of light, to produce a lower quality of gas than in the North; but it was all a question of price. After a century of gas lighting, he should be rather inclined to increase the illuminating power than to diminish it

Mr. J. HEPWORTH (Carlisle) said he did not come from Scotland, where they made 28-candle gas, but from a Border town, where, because they were near Scotland, they were asked to make it of 19 or 20 candle power. He had formed the opinion, after many years' experience, that this extra illuminating power was not worth the cost; and he was therefore very glad to have heard the paper. The last four candles—from 15 to 19 candles—could not cost less, and generally cost a little more, than 6d.; and the consumers could be supplied with gas at 6d. per 1000 cubic feet less, provided the gas were sent out four candles poorer in lighting power. Now, anyone who had been to Edinburgh must have noticed that, with all the 28-candle gas or whatever it might be, that was used there, the effect was poor; and they must either doubt the statements made as to the illuminating power of the gas, or the wisdom of the authorities in using the burners they did for consuming it. The last speaker said they did not want less, but more, light; but he (Mr. Hepworth) said they ought to get that "more" out of better apparatus, rather than by compelling them to manufacture a higher quality of gas by using either rich coal or even oil. Why should they purposely incur the extra cost, which in his own case amounted to thousands of pounds a year, of enriching the value of the gas, when the consumer persistently, by reason of the burners he used, reduced its value 30, and sometimes even 50, per cent. Did not this call for a new policy on the part of gas makers, in the direction of educating the consumer as to the consumption of gas, and, if possible, of supplying him with the appliances to do it? While listening to the paper, he had been working out a simple calculation. It had been said that in one town the working man consumed something like 12,000 or 14,000 cubic feet of gas per annum. Suppose this 12,000 cubic feet were supplied for 6d. less, and the man were induced to put in a proper burner, he could well afford to do it, and still save money; while he would have as good a light with 15 as with 19 candle gas. For 3s. he could have the best burners that were made; and, instead of reducing his gas persistently to about 10 candles, he could bring it up, by the use of flat-flame burners, nearly 12 or 13 candles—fully 25 per cent. Why should not gas makers consider whether they could not induce the persons they represented to send out a somewhat lower quality of gas? They could then afford to spend 3s. in burners on every small consumer, if they were going to save 6s. the first year in the cost of gas; and the working man himself would be benefited by the saving ever afterwards. If they could have a campaign carried out successfully throughout every town and village where gas was consumed, and could induce persons to use proper burners, they would be the means of benefiting the whole community. He did not think Mr. Newbigging had taken into account the question of enriching gas by a cheaper method than cannel. He (Mr. Hepworth) had heard it stated that it could be done much more cheaply by oil; but even then it was not, in his opinion, worth the cost. The physical conditions had, no doubt, a great deal to do with the effect produced by the gases. Mr. Humphrys had referred to Paris; and they had seen the same thing at home. If they noticed the gas on a dull, heavy day, and the next day happened to be frosty and dry, they would find that the same gas would appear two candles better to the eye. He thought the title of the paper, with the forcible elucidation which Mr. Newbigging and Mr. Sugg had given of it, would point out to some of their scientific friends the desirability of going to work to prove whether Mr. Newbigging was right or wrong in his conclusions, especially with regard to the accuracy of the photometer, and whether they could not devise some method of taking the lighting effect at different distances and angles, and ascertaining what, after all, was the effect which could be obtained from gas of a certain illuminating power given off at a certain point. They were much indebted to Mr. Newbigging for starting the subject. No one wanted the people of this country to have less light than hitherto; but the question was whether they could not obtain more light, not only without increasing the expense, but even at less cost.

Mr. J. STELFOX (Belfast) said Mr. Hepworth had stated that the last four candles were not worth the extra 6d. they cost; and he quite agreed with him. But if they could obtain this amount of enrichment at no greater cost than the same proportion of four candles, or rather at a much less cost, would the objection still hold? If by any method they could increase the illuminating power by two, three, or four candles, without any sensible increase in cost, should the quality be reduced simply to standardize it to (say) 15 candles, or should they not rather thankfully accept the

higher power? He always maintained that it was distinctly a loss to pay 2d. per candle for cannel if the ordinary coal gas only cost 1d. per candle; but if they obtained an equivalent for the cannel actually at the same price as for coal or less, the question assumed a different aspect. Was it to be said they would not take anything at all which made gas of higher quality than 14 to 15 candles.

Mr. R. Mitchell (Edinburgh) said he did not think Mr. Carr had taken into consideration the amount of gas that was being consumed in London; and this was the real factor. If the quantity burnt in the public lamps in Parliament Street were reduced to 1¾ cubic feet per hour, as was the case in Edinburgh, he should like to see what the effect would be. In comparing diffusive power and illuminating power, the quantity of gas consumed must be taken into account. Simply to say the light was beautiful, and leave altogether out of calculation the amount of gas required to give it, was utterly delusive.

Mr. Carr remarked that he had not been referring to street lighting; he was thinking rather of the burners in the shop-windows, which appeared to be passing about 5 cubic feet of gas an hour, the same as they did in Manchester. He had not Edinburgh in his mind at all. He did not consider there was more gas being burnt in London than in many other places he knew of, where the gas was said to be three or four candles higher; but a much better light was obtained.

Mr. H. Wilkinson (Harrogate) said that no doubt a great deal depended upon the atmospheric conditions. The standard at Harrogate was 14 candles; and, using coal from the North, it became a serious question whether his Company would not have to resort to some system of enrichment, or whether they would be able, by the study of the mode of burning the gas, to furnish to the consumer a certain illuminating effect. They were confronted with this fact, that, with 14·7 candles at the photometer, the lighting effect was not satisfactory when consumed with the ordinary appliances; but they were able to supply the consumers, at a nominal cost, with a burner which would yield an equivalent of light nearly approaching that shown by the photometer. The result was extremely gratifying; and complaints from consumers were very rare. It was frequently stated, by those who came from towns having a higher illuminating standard, that they appeared to have better gas; but he attributed it entirely to the mode of consumption. The President had referred to the importance of considering how gas could be popularized. It could be done by rendering assistance in the introduction of improved gas-burners, more especially those of the regenerative and incandescent kinds. In common with other places, they thought at Harrogate they would have to fear an invasion of the electric light; but, with the appliances they now had, they had no fear, especially if they could induce the public to introduce the ventilating lamps referred to in the President's address. The question raised by Mr. Newbigging was a wide one. If the additional candles were not worth the cost, what an enormous amount of money they must be wasting in England every year. Looking over the Board of Trade returns, he found the majority of gas companies had a standard of from 14 to 16 candles; and in most cases the gas was said to be 1, 2, or 3 candles beyond the standard—pointing to the belief that a high quality of gas was preferred. But it seemed to him, as the result of the paper and the discussion, and of a further investigation of the subject, that the pockets of the consumers might be saved an enormous sum. There was a Research Committee connected with the Institute; and he thought it would be well for that Committee to investigate the subject of the highest possible development of light to be obtained from gas of varying illuminating power. If they could not get one uniform burner suitable for all gas, it seemed very desirable that each individual gas engineer should devote the closest attention to the production and use for his own gas of appliances that would give the best results.

The President said the discussion had travelled over a wide area. He regretted that Mr. George Livesey was not present, because he had given evidence, in connection with the southern district, and more particularly the West of England; and his principal point was this—that it did seem a pity the Legislature should compel gas companies to increase the illuminating power of gas by one or two candles, when it was necessary to use cannel or other modes of enrichment which caused trouble. His idea was that, where gas companies or corporations had been supplying for a long period, and where the consumers were fully satisfied with the gas, that it was a pity, if they applied to Parliament for an extension of their powers, to impose upon them an increase of a candle or two, causing extra cost and trouble, and which would only improve the light by 6 or 7 per cent., when by an improvement in burners they could get an addition of 10 or 20 per cent., at a very small expenditure. His idea was that, instead of increasing the illuminating power, the consumer should have a reduction in the price of gas, as, by using a proper quantity, he could, with a good burner, get more value out of it with ordinary gas than he possibly could with a richer kind. If their friends in Edinburgh would increase the quantity of gas to double what it was now in their public lamps, they would probably get the high candle power they talked about. But the question was: Had they a sufficient quantity to heat the particles of carbon up to the high state of incandescence necessary to bring out the light there was in the gas? He did not think they had. It appeared to him that it would be a good thing if they were to district themselves, so that their friend Mr. Sugg could give them, in a certain locality, a burner which would properly consume the gas in that district. There might be one quality in the South, another in Yorkshire, and perhaps a higher one in Scotland. When they came to Manchester where the gas supplied was supposed to be of 20-candle power, Mr. Carr asked: Was it 20-candle? When he (the President) was there, sometimes it was 20 candles, sometimes considerably over, and at others a little under. The difficulty was, when one had dozens of different kinds of material to deal with day by day, to maintain a uniform illuminating power. Someone had referred to complaints coming in when the gas was two candles higher; but he thought it was when managers let the consumers "taste blood" that they had the complaints. They probably gave them a very good gas one day, and not so rich a gas the next; and it was the variations and contrasts which caused complaints, when very rich gases were used.

The Secretary then read a letter received from Mr. H. Townsend, of Plymouth, who expressed regret that he was not able to be present, but sent some remarks on the paper He stated that for ten years he had charge of gas-works in the North, where the illuminating power was from 18 to 19 candles; and for nearly as long he had been in gas-works in the South, where it was 14 to 15 candles. He had been struck with the very small difference in the illuminating effect produced with these widely differing qualities of gas. The process of manufacture was about the same in each case, with the exception that the 18 to 19 candle gas was purified mainly with oxide of iron, while the 14 to 15 candle gas was purified with lime only; and this, in his opinion, was a very important point. His first journey between the North and Devonshire was made in February four years ago. As he travelled at night, he amused himself by comparing the qualities of the gas burning at the railway stations through which he passed; and he tried to distinguish the methods by which it was purified. He noticed there was a strong line of demarcation between gas purified by oxide, and that purified by lime—the former having a yellow colour, while the latter was white; the carbonic acid being mainly responsible for the difference in the colour. He made up his mind, when he came into South Devon, that he was in a limestone region, because there was more white gas in that district than anywhere else. When he reached Plymouth, he found that the gas was white there too; and he at once concluded that it was purified exclusively with lime. Finding, on inquiry, that this was the case, he was strengthened in his convictions, From his observations on that journey, he formed the conclusion that gas of 14 or 15 candle power, purified exclusively with lime, was quite as good a commercial article as 18 or 19 candle gas purified with oxide of iron; and subsequent experience had strengthened this conviction. He had also found less difficulty in competing with the electric light with white gas of low quality than with yellow gas of higher illuminating power. What, then, became of the extra four candles? Doubtless some was absorbed by the colour; but he thought the best place to look for the remainder was the ceiling. The higher illuminating power often doubled the damage done to ceilings and decorations; but with the lower quality gas he never had this point raised. This quality was also

better for heating; the other choked up the slide-valves and the burners of cooking-stoves. For heating purposes, again, the price was a great consideration. At Plymouth they were able to sell gas at 1s. 9d. per 1000 cubic feet, which virtually placed that town, from an industrial point of view, in as favourable a position as if it was situated on the coal-fields, as there was scarcely any cheaper source of power than good coal gas at that price. Of course, in many towns, it was not possible to use lime exclusively; but where it could be used, a great mistake was made to raise the standard of illuminating power so as to necessitate the use of enrichers of any description.

Mr. Newbigging, in reply, said the last sentence in his paper contained the remark that, if there was not an eager and emphatic declaration in favour of the policy he advocated, he should be disappointed. All the same, he did not expect his views to meet with general acceptance. As a matter of fact, he knew they would not; and therefore he was not greatly surprised at the opposition they had incurred from some of the speakers. Prejudices and preconceived notions were extremely hard to eradicate. It was only natural that much discussion should be expected to follow the expression of novel views on any subject; but he was not without hope that even those who were strongest in opposition would, after full consideration, have a larger measure of illumination vouchsafed to them. On the other hand, he was gratified that the discussion had tended largely in favour of the views he had expressed. It was pleasing to observe that even those who were not at present willing to go the full length with him had given a modified acceptance to what he had stated. He believed the discussion had shown how extremely ignorant they were generally on this question of illuminating power and illuminating effect. One speaker objected to any reduction in lighting power, because, he said, if one light would serve for two, assuming the gas to be of high illuminating power, there must be less deterioration of the air in a room. This might be so; but he (Mr. Newbigging) could not see it. He presumed it would be admitted that the light yielded by any gas was due to the proportion of carbon contained in the flame. It must take a larger quantity of oxygen to consume the richer gas, even if the flame was smaller; and therefore he did not see where the advantage came in. In Scotland, they required to have a high pressure in order to drag air into the flame to consume the carbon. This was one of the secrets of the really low illuminating effect of Scotch gas. The air was drawn into the flame, and, as a matter of fact, the flame was turned partially into a Bunsen burner. Mr. M'Gilchrist had said that he (the speaker) was for degrading the illumination. On the contrary, his argument showed, or attempted to show, that, by using gas of lower photometrical power, they could get higher illuminating effect. He was for raising this throughout the country. It was of no use telling him they had as good illuminating effect from (say) Manchester gas as they had from the gas supplied in London, because he knew they had not. He had had a long experience of Manchester gas, and he knew the illuminating effect was not equal to that of London gas, which was professedly of four candles lower power. But it could not be too strongly urged that there was a great difference between power and effect. He did not mean to say he could thoroughly explain it; but he had, he hoped, given the members food for thought, and perhaps some day they might be able to satisfactorily account for the phenomenon. What a magnificent light there was in the electric arc, from the point of view of intensity, yet how lacking it was in diffusive power; and it was, he believed, proportionately the same with the light afforded by the richer gases. When tested by the photometer, there was intensity which gave high illuminating power, but not a proportionate diffusive power. Mr. Irons found that the light from a well-made oil-lamp was wanting in quantity just as the electric arc was, although it afforded intense light at the point of combustion. Here, again, low diffusive power was encountered. He agreed with Mr. Humphrys that in Paris the atmospheric conditions enhanced the quantity of light given out by the gas-flame, and that it contributed to wider illumination. He must admit that Mr. Woodall made a good point when he criticized the suggestion of reducing the illuminating power of the gas yielded by the richer coals by an admixture of inferior coals. But he (Mr. Newbigging) did not lay much stress upon that. All he meant to imply was that it was a wiser policy to do that than to increase the cost by enrichment without deriving a corresponding advantage. The one was more sensible than the other. Mr. Woodall, in his remarks, had misrepresented him most unfairly in suggesting that he advocated the supply of impure gas. He had done nothing of the kind. On the contrary, he advocated the production and sale of gas of the highest attainable purity, and, if of a lower photometrical power, yet giving a high illuminating effect. High photometrical value and purity did not by any means go hand in hand. Take again, as an example, Manchester gas, which contained an average of about 40 grains of sulphur—chiefly bisulphide of carbon—per 100 cubic feet. Reverting again to Mr. M'Gilchrist's remarks, in Scotland they had set them the example of reducing the standard. What did Glasgow do a few years ago? Glasgow went to Parliament and succeeded in convincing the Legislature that a standard of 20 candles was better than one of 25 candles; and it was reduced accordingly. This was a wise and sensible step on their part; and if they could see their way to a further reduction to (say) 15 candles, it would show that they were growing in wisdom. He would not detain the meeting any longer as there was much business to be done; but he might find a further opportunity of replying to some of the points which had been raised.

Discussion on Mr. George Anderson's Paper on "Differential Charges for Gas."

Mr. Isaac Carr (Widnes) remarked that, if he understood Mr. Anderson's proposal aright, he should view with something like apprehension the introduction of his scheme into any growing industrial town. Drowning men would catch at straws; and such a proposal might have the effect described in towns which were dying out of existence. But how would it work if introduced into a manufacturing town, where factories had been at work for a number of years? Along came a new industry which applied for gas; and he supposed it would get its maximum limit fixed on its first year's consumption, after which it would go on increasing in size, and in the quantity of gas consumed, until, in a few years, it became as large as the old-established works which had helped to build up the business of the company, and yet the new consumer probably would have his gas 10 per cent. cheaper. If such a system were introduced, they would have private gas-works being put up all round, and all sorts of difficulties arising. As Mr. Anderson had stated, it was very difficult to do justice to everyone; but he thought it was much better to leave matters alone than to commit such a gross injustice as that would manifestly be. The author talked of the price of gas being reduced from 6s. and the ordinary price being 4s.; but take Sunderland, Newcastle, Plymouth, and other towns, which were selling gas for something like half this price. He thought these prices were rather lost sight of when the author talked of 3s. being the recognized proper figure to charge. Half this was nearer the amount the companies in the above-named towns charged; and notwithstanding they still continued to pay their maximum dividends.

Mr. C. A. Craven (Dewsbury) asked Mr. Anderson how he would manage with a new consumer where there was no rule to go by as to the former consumption. Perhaps he would put down the amount that ought to have been burnt. He (Mr. Craven) was altogether in favour of differential charging; but he saw great difficulty in doing it, unless they registered by a separate meter the gas consumed at the lower charge. This was the course adopted in his town. They made a difference of 1s. per 1000 cubic feet; and they said: "If you will take a meter, we will connect the stove, or whatever it may be, if you will pay for the materials." He was even inclined to go a little farther, and make no charge for the second meter. He could not see any injustice about it. If people would not avail themselves of the privilege, why should they complain of injustice. They all wanted to get an increased day consumption of gas, especially in towns like his own, where there was such a difference between the consumption in summer and winter—the latter being as from four to five times to one. Mr. Carr had omitted one thing, when speaking about places where they only charged a little more than half the price mentioned. In many instances it was entirely a question of the capital charges. The great reason that his friend Mr. Townsend was able to

work on such favourable lines was that in his case the capital charges were not above one-fourth or one-fifth what they were in some other places. The initial price was often ruled by the amount which had to be paid for capital charges; but they could not say the capital was more than they liked, and therefore they repudiated it. When a debt was contracted, it was their honest duty to meet it.

Mr. CARR said that in Newcastle and Sunderland they paid maximum dividends.

Mr. CRAVEN said it was a very great thing if they could increase the day consumption by any reasonable means. The more they could do this, the better they would bring down the capital charges and meet the consumers.

Mr. J. STELFOX (Belfast) said he had always had a great objection to differential charges, and had never heard of the system succeeding anywhere; but he confessed that the proposal of Mr. Anderson seemed fairer than the other plan of selling gas at one price for one purpose and at a different price for another. Mr. Craven had raised one difficulty; and there was a further one which occurred to himself. A man might open an office, to start with, in a town, and then, if he were at all successful, he might build a mill behind it, and have an enormous consumption of gas at a low price. The neighbouring millowners would, of course, object to that; and he thought public opinion would rule that such a thing was unjust. As regarded differential prices at all, after retiring from active life, his father went to Southport, and there thought he would take advantage, as a consumer, of having some 3d. per 1000 cubic feet deducted from the price of gas for heating purposes. He had two gas-stoves fixed in the lower rooms, which were easily connected from the cellars; but when he wanted one in the bed-room, he thought he would rather pay a higher price for gas than break up his house for the sake of making a connection to the stove meter. At Southport, he believed, they had now discontinued the system, except to those to whom it was originally conceded. His own experience was that the better way to induce people to burn gas was to put the means of consuming it readily into their hands. A few years ago, there was not in Belfast a gas-fitter who did not tell anyone who asked about gas-stoves that they were a nuisance, and advised customers to have nothing to do with them. But by supplying these stoves at cost price, and fixing them, the Corporation had now something like 5000 stoves out, where there would not have been 50 if they had left things alone. He thought no one would come in on the chance of getting the small reduction in the price of gas. The real thing they were afraid of was the capital outlay. Many years ago, he had some correspondence with an eminent firm of gas-engine makers; and, in reply to one of his letters, they asked him whether it had ever occurred to him to recommend people to lower the price of gas as an inducement to use gas-engines. He replied that he had never known an instance in which a person had been deterred from employing a gas-engine on account of the cost of the gas. But he had heard of a great many cases where they would not go to the expense of an engine; and he asked them if it had ever occurred to them to lower the price of their engines. His experience justified him in retaining this opinion. If they wanted to get people to consume gas, let them have the means of doing so without capital outlay. He preferred Mr. Anderson's suggestion to the other; but he could not agree with either.

Mr. J. BRADDOCK (Radcliffe) said that they all desired to extend the use of gas, if it could be done in a legitimate way; but there were one or two points on which he should like to obtain further information from Mr. Anderson. First of all, as to the difficulty raised by Mr. Craven with new tenants in obtaining a normal from which the reduced price could afterwards be determined; and there was the further difficulty as to the inequality of consumption by various tenants. There would be one consumer who burnt 10,000 cubic feet of gas (say) at 4s. By this system, they offered him, if he burnt a further 10,000 cubic feet, to supply it at 3s.; making his aggregate account as 20,000 cubic feet at 3s. 6d. His next-door neighbour might also take 20,000 cubic feet of gas; but this being his normal quantity, and not being inclined to exceed it, he was called upon to pay 4s. He (Mr. Braddock) could not see the fairness of this method.

Mr. NORTON H. HUMPHRYS (Salisbury) said the matter under discussion could not be worked out on abstract principles or theory. What was justice in one case might be injustice in another. In approaching the subject of differential charges, the first question to be considered was the sale price. In large towns, where they could sell gas at 2s. 3d. or 2s. 6d. per 1000 cubic feet, the question could be dealt with in an easy manner; but when they came to small districts, where they had to charge 3s. or 4s., or even more, difficulties would arise. It was not as if they could choose to sell either at an even price or at differential prices; but the question of a differential price was forced upon them. As a member of the Boards of several small Gas Companies, he should be delighted if he could learn how to get a good business at one even price. If he could induce anyone to use a 12-horse power gas-engine, and pay 4s. or 4s. 6d. per 1000 cubic feet for the gas, he should be exceedingly glad; but they would not do it. The consumers said they would not have the engines. In small districts, such as he had indicated, perhaps the fairest way all round was to make a liberal allowance for gas-engines, and for a large consumption of any kind. He had an instance only last year of a small company with an output of about 10 million cubic feet per annum. Some twelve months ago, there was an application from a consumer who was prepared to use a 12-horse power gas-engine; but he would not pay the price of gas usually charged. They looked into the question; and the result was that, by means of a scale of discounts, they gave him considerable advantage, and he put in the engine. Entirely as the result of the extra gas consumed by that engine, they were able this year to make a reduction in price of 5d. per 1000 cubic feet for all the consumers. He did not know that the latter troubled about the justice or the injustice of the differential charge; but they were very pleased to have the reduction of 5d.

Mr. T. TRAVERS (Cork) said his experience in the South of Ireland was somewhat different from that in the North; but that was not a new thing in Ireland. They had great difficulty in introducing gas-engines into Cork. But they made a reduction of 10d. per 1000 cubic feet; and the result had been that they had had frequent applications during the last two years. There were about 100 engines now at work in Cork; and they formed some of the largest consumers. He did not see any more injustice in this than in a railway company taking a similar course. He remembered some years ago travelling from London by way of Milford to Cork; and there was then a very poor traffic. But the railway companies altered the system, and anyone could now travel from London to Cork by Milford cheaper than he could travel to Milford; and the Milford people did not complain of the injustice.

Mr. STELFOX said the illustration Mr. Travers had given was not that of a differential charge. As a matter of fact, the railway companies could not charge differential rates. Mr. Travers and every other person could now travel from Cork to London at the same price. If a railway company gave any consideration to one person, they must give it to everybody, or they would be brought up at once before the Railway Commission.

Mr. J. W. BUCKLEY (Falmouth) said he thought that Mr. Anderson's proposition would apply to very small towns only. At Falmouth they had a special clause in their Act of Parliament which compelled them to supply the local authorities at 10 per cent. below any private consumer for lighting purposes. The system adopted of differential charging was that each consumer wishing to have gas for heating or for other purposes than lighting must have a separate meter, for which they charged half the ordinary rent—no charge being made for fixing. If they did not adopt this system, they would have great complaints. One objection to Mr. Anderson's plan had already been mentioned—that two men consuming the same quantity of gas would pay different rates. It did seem unfair that an old consumer of (say) 10,000 cubic feet of gas per annum, should pay more than his neighbour who increased his consumption, for example, from 6000 to 9000 cubic feet. Again, a new consumer, if he knew that Mr. Anderson, after twelve months, was going to give him an increased discount, would in all probability not act quite in the ordinary way, but would only put in a few burners, and then he would say: "I am only consuming 2000 cubic feet this year; but supposing I consume more, you will let me have it at a cheaper rate." He thought the aim ought to be to please the majority.

The PRESIDENT said it appeared to him that the cases Mr. Anderson had mentioned were very special ones. He

was overcoming difficulties in districts where there was a reduction in trade, devising means for paying a larger dividend, keeping out the electric light, and other things. But that was very different from the case of a town where the business was increasing year by year. He had expressed himself before on the question of differential prices; but his remarks then applied to what might be called an ordinary undertaking. Of course, it made a great difference where the business was so small that one gas-engine caused a very great increase in the returns. Where it was a moderate-sized town, he quite believed in charging one price to all consumers; and he did not consider it necessary to offer discounts to make them pay. If a man contracted for a thing and had it, he should pay for it; and he (the President) did not see why that man should go on for two quarters with an unpaid account. Some years ago, when he was at Maidstone, the Directors instructed the collector to call in the money; and if the people did not pay in a certain time, the usual means were adopted to obtain it. This was carried out so thoroughly, that there were no entries in the arrears column; and it had worked very satisfactorily for the last fourteen years. This practice did away with a considerable amount of book-keeping, and a lot of contentious criticism among the consumers. He was very sorry for Mr. Buckley's company, who were forced by the Legislature to supply a public body at 10 per cent. less than the ordinary consumers, because a public body was really like a multiplicity of very small consumers, and the leakage was much greater than it was ordinarily, as there was, as a rule, one service for one light only.

Mr. Buckley remarked that he understood the special terms allowed to the local authority in question were a concession to them which prevented the introduction of the electric light.

Mr. Anderson, in reply, said several gentlemen had asked questions, but none of them had given the slightest answer to the one he had asked in the paper. He pointed to places where the gas consumption had been declining steadily year by year, and where the dividend had gone down from 10 to 8 per cent.; and he asked what they would have done. Mr. Stelfox's cure was no cure at all. There was all the difference between the North and South of Ireland. He (Mr. Anderson) found it was very difficult indeed to increase the consumption, not only in the South of Ireland, but in the South of England. Mr. Isaac Carr had talked about competition in gas; but if one gas company came in at a lower price, the other would have to follow. He, however, was not talking of anything of the kind. If any other people came into the town beyond gas people, and acted in a similar way, the same thing would follow. The man who "cottoned" most to the public would get the advantage. With regard to the former consumption, he simply went by facts. He looked into the books to see what the consumption had been. If they used 10,000 cubic feet of gas last year, he said: "For anything over that, you shall have it at a lower price." Of course, if he found anyone trying to "humbug" him, as in the case suggested of a man opening an office and then building a mill, he should know how to deal with him. He should let him have cheaply what gas he burnt in the office, but he should charge him for the mill at the usual rate. If anything of this kind were attempted, he should very likely reject the principle. He was not bound to it for ever, if he saw that anything unfair was attempted. Mr. Stelfox said the fittings were the chief thing; and no doubt there was a great deal of truth in that. Teaching people, putting up fittings and a meter, and all that, free, was very good; and it had attracted a class of people who in this country did not formerly burn gas. In Scotland it would not have done so well, because there almost every man had gas in his house, if it consisted of only one or two rooms. He was sorry for the man who could not increase his trade so as to get a portion of his gas at a lower rate. But he could not help it; and he did not think, on the whole, those cases would often occur. He scarcely ever found a man who could not burn more gas, or eat or drink more of something, if he had it cheaper. Mr. Humphrys had given them a very good illustration from his experience. A year ago, in a small country town in Ireland, a man was putting up a 10-horse power saw-mill. They supplied him with gas at a low price, for sawing; and he was immensely pleased. Otherwise he would have had to use his sawdust, which he could sell better in another way; and the engine cost so little for attendance, that he was one of their best customers. He had written to the secretary of one of the companies for a few instances of consumers having benefited by the change; and this gentleman had taken out the quantities, and sent them to him, for the quarter ending March, 1894. Of all those who had consumed 10,000 cubic feet and upwards at the reduced rate of 3s. 4d. per 1000 feet, there were in one district fourteen consumers; their average additional consumption amounting to 16,322 cubic feet. In another district there were thirteen consumers; the average additional consumption being 17,967 cubic feet. The effect produced was that they were getting more gas sold; and it would give them an opportunity so much sooner of reducing the price of the whole.

Discussion on Dr. Voisey's Paper on "An Improvement in the Construction of Atmospheric Burners."

[At the conclusion of the paper, Dr. Voisey conducted some experiments with his new burner (illustrated in the Journal last week, p. 1224), which had been fitted up by the makers, Messrs. Richmond and Co., Limited, in conjunction with one of the ordinary type. Notwithstanding the severe tests applied to it, with fan and bellows, under various pressures of gas, it fully sustained the claim made as to its non-liability to light-back.]

Madame Alting-Mees asked whether, if the burner were applied to a cooker, and drops of fat fell upon it, this would cause it to light-back.

Mr. G. Anderson (London) said the paper was a very valuable one, all the more so from the fact that the author had given such ample proof, by experiment, of the great success he mentioned in the paper. No doubt many gas-fires did light-back; but some were less objectionable in this respect than others. He could fully confirm what the Doctor had said about the unpleasant consequences which followed, and which were not confined to persons suffering from physical disorder. He knew one gentleman in particular who could tell at once if there was anything wrong, simply by a certain feeling on the skin of his face and in his eyes. It was of great importance to have articles which would not produce such deleterious effects. They were having a good many gas-fires brought forward; and this seemed about the best thing he had seen. He had had to remove gas-fires from his own house and get others, on account of their imperfections. Nothing would tend more to the employment of gas for heating purposes than the introduction of a thoroughly good burner.

Mr. A. P. Main (Glasgow) said there was no doubt that up to now the lighting-back of gas-fires had been one of the greatest possible obstacles to the popularization of gas heating; and they were greatly indebted to Dr. Voisey for the manner in which he had overcome this difficulty. He (Mr. Main) had known for many months that the difficulty could be entirely overcome. He had had a gas-fire working for the last six months for an average of 15 hours per day in a draughty chimney; and it was absolutely impossible, under any conditions, to make it fire-back. This was accomplished in what he thought was a simpler manner than that now shown. They had purposely refrained from putting this burner on the market until every possible test had been made with it under the most disadvantageous conditions; and he merely mentioned it now to show that more than one member had been working in the same direction. As to the comparative value of the two things, of course he could not say anything; but practice would probably soon determine which proved to be the best. He merely wished to say that the object of absolutely preventing firing-back had been accomplished in another, and he thought a simpler, manner; and also that the question had been solved of making the burner almost, if not absolutely, noiseless. As a gas-stove manufacturer, he wished to express his indebtedness to Dr. Voisey for the very interesting series of experiments he had conducted. With regard to his own stove, full details would have to be withheld, for certain business reasons, for about another month.

Mr. David Terrace (Middlesbrough) asked if there was greater efficiency with this burner than any other, owing to the convoluted passage for the gas and air. He said they

knew of one regenerative Bunsen burner in the market which had a higher efficiency; and he should like to know if this possessed the same advantage. They knew that one of the great hindrances to the use of gas for heating purposes was the expense; and if they could get a burner which was more efficient than the common one, it would very much assist them.

The PRESIDENT said that, when he was at Maidstone, twenty years ago, he introduced gas-fires into every house belonging to the medical profession. He did not know the value of the burner he then introduced until very recently; but certainly it was one which would not fire-back. It was, he believed, as efficient as the one they had seen that morning; and one of its advantages was that it could be fixed in an ordinary grate, so that the products could go up the chimney. Since then, gas-stoves had made great progress; and the regenerator burner and stove were brought out. Last year he thought he would take out the old burners he had had in use for a long time, and get the best regenerator stove in the market. He believed he had obtained the best—at any rate, it was by a very scientific stove maker; but it had been an intolerable nuisance to him ever since, because it would fire-back. If the door were opened, or a lady crossed the room near the stove, it would at once light-back; and it was only then that he discovered how valuable his old-fashioned burner was. There were hundreds of them in use at Maidstone; and many who were present had had them. All he wished to point out was that, however much he appreciated what Dr. Voisey had done, he could not allow him to say that this was a recent discovery. He did not look on his own burner as a discovery. Having found great difficulties with the burners in use, on account of draughts and so on, it led him to carry out many experiments; and at last he succeeded in making a burner which would not fire-back. [The President drew a rough sketch of the burner.] He only brought it out locally, and used it locally. Anybody could make it, though perhaps it would not be quite so cheap as the one the Doctor had shown. It was more a question of area than anything else. He had a large bulb at the bottom, where the air was admitted; and round this there were large openings, so that any puff of wind would blow from one side to the other, on the same principle as that which had just been explained. This bulb was reduced to 1 inch above, with $\frac{3}{4}$ or 1 inch gas tubing (it would not answer with $\frac{1}{2}$-inch). This tube he used to tap with a $\frac{3}{8}$-inch pipe, which formed the burners. One advantage was that there was such a thorough mixing that the end flames were exactly the same size as the centre ones. It was simply a question of area. Any puffing about did not affect it, because there was plenty of room for expansion or contraction. These burners he fixed in all his grates in Manchester, when he went there; and he was very sorry he had discarded them in favour of what he thought was an improvement. Of course, there was the improvement that, instead of so much of the heat going up the chimney, it passed through a series of regenerator arrangements, and the room was better and more economically heated; but the burner was continually giving trouble. There was no doubt Dr. Voisey was the inventor of the arrangement now before them. Of course, it was the application of a principle which tended to the advantage of the gas industry generally; and no one was more delighted than he to find anything of this kind brought forward. It would be propagated in every direction as the result of that meeting; and it would be an additional proof of the advantage of such gatherings.

Mr. J. HEPWORTH (Carlisle) said they were very much indebted to a member of the medical profession for coming to give them so excellent a paper on the subject of gas-fires. Along with many present, he had done a good deal of late years to introduce these fires. Contrary to the experience of the President, who told them that every member of the medical profession in his town had used them, he found that, very generally, medical men were opposed to them; and it was rather in spite of their professional opinion that one succeeded in getting gas-fires introduced. However, the burner they had seen that morning—and, it appeared, some others to which reference had been made—showed so great an improvement, that perhaps in future there would not be the same difficulty in dealing with their medical friends.

Dr. VOISEY, in reply, said he did not think the dropping of fat would affect the efficiency of the burner. The only way in which it might be conceived as being likely to do so would be by gaining entrance down the nipples, and so getting at the nozzle; but even then the heat would be sufficient to dispel what little could penetrate in that way. One gentleman had spoken of another burner he had designed; but as no particulars had been given, he could say nothing about it. With regard to the question as to efficiency, he did not quite understand whether the comparative cost or the power was meant.

Mr. TERRACE said he referred to the heat given off per cubic foot of gas consumed.

Dr. VOISEY said the new burner which had been shown consumed, with 10-10ths pressure, 30 cubic feet an hour; and with 2-10ths, 10 cubic feet. The one of the ordinary type by its side had the same diameter of tube, but had a larger gas consumption—something like 40 cubic feet an hour at 10-10ths pressure. In the case of the new burner, the resistance offered by the shape of the tube to the entrance of the air also restricted the amount of gas issuing from the nozzle; and if the pressure-gauge were put upon the pipe between the tap and the burner in the two cases, the pressure with a full supply of gas would, in the case of the new burner, be fully 10-10ths, whereas in the other case it would not be more than a little above 7-10ths—the greater pressure showing that less gas was passing out of the nozzle of the burner. But the heating effect of a given quantity of gas would be the same, whether it were consumed in the new or the old burner. Mr. West objected to the expression "it has recently been discovered." The point he referred to there was the reduction of the minimum point of safe pressure. The *Lancet* Commission spoke of a minimum of 4-10ths. None of the burners with which they experimented were at all efficient at any pressure less than that. This burner would work at a pressure of 1-10th; and although it would not stand a severe test at so low a pressure, it would, under ordinary circumstances, burn safely without firing back. He could not conclude without again thanking the Council of the Institute for the honour they had conferred on him in asking him to read this paper; and he was glad that they considered his modified atmospheric gas-burner worthy of attention on such an occasion as this. He had some reluctance in accepting the invitation, feeling that he might venture out of his depth; but by confining himself simply to the subject-matter of the title of his paper, he trusted he had made himself clear, and had not offended professional ears by the exposition of any technical "heresy."

PAPERS READ AT THE MEETING.

NOTES ON GAS MANUFACTURE AT WALLASEY, WITH SPECIAL REFERENCE TO ENRICHMENT BY CANNEL.

By H. ASHTON HILL, of Wallasey.

Having been prevailed upon to read a paper before the Institute, it occurred to me that I could not do better than give some particulars of my own experience in the manufacture of illuminating gas of a definite standard, as, so far as I am aware, no paper covering the ground proposed has appeared in our "Transactions." It is hoped, therefore, that what may be advanced, and elicited in discussion, may prove of practical advantage to many. My remarks will be more particularly directed to the question of the enrichment of gas by means of cannel, as I have thought that at the present time, when so much is heard about the merits of the various processes of oil enrichment, it is very desirable that some consideration should be given to the cost of cannel enrichment.

Before going on to the main portion of my paper, it will be as well to anticipate some of the objections that may possibly be urged as to the basis of comparison of my own experience with the published statements of the various authorities who from time to time have related their experience of oil enrichment. Under this heading, I purpose to include such points as the size of the works, their situation in relation to the coal-fields, the storeage of coal, and the system of retorts and furnaces. The make at the Wallasey Gas-Works for the year ended March 25, 1884, was 80 millions; and for the year ended March 25, 1894, it was 169 millions.

The works are not, I think, more favourably situated than the majority of others. There is certainly the choice of coal from several different coal-fields, and the carriage

to Birkenhead varies from 3s. to 7s. per ton, to which must be added a tollage of 1s. per waggon payable to the Mersey Docks and Harbour Board, over whose lines the traffic has to pass before reaching the siding into the gas-works. Then there is a charge of 1s. 6d. per waggon for the haulage over these lines. These tolls and haulage charges are equal to 4d. per ton; and this further increases the railway rate.

As to the storeage of coal and cannel, while not wishing to deny any advantages which others may consider are obtained from the storeage of our raw material under cover, I have not, up to the present, thought it necessary to construct other than open stores; and the following circumstance, among others, tends to strengthen my view of this matter. Some four years ago, a North Wales coal was being used, which was of excellent quality, giving as it did a good yield of gas and illuminating power, and being very uniform in the deliveries, though not specially large or round. In making new contracts, this coal was again offered, but at an advanced price, so that another coal was accepted. This, though not quite so good, was better value at the price tendered, and has been used since; so that extended experience of the two kinds has been obtained. For reasons which need not be entered upon, about 200 tons of this North Wales coal remained in a heap in the yard for four years. It was then used up; and the point I wish particularly to draw your attention to is that, immediately we began to use this coal, our results went up, and were maintained while its use continued, and they dropped in the same marked manner upon resuming the carbonization of the other coal referred to. I think it will be conceded that there was nothing much the matter with the coal when it produced, with the addition of 10 per cent. of cannel, 11,346 cubic feet of 19·13-candle gas per ton.

The foregoing is not the only instance of my having observed a similar occurrence in the case of coal; and with regard to cannel, the depreciation has never, in my experience, been capable of measurement. We have had rich Abram cannel in open stock for years together; and, on coming to use a definite percentage of it, it has given the results we required and expected. Mr. M'Gilchrist, in his paper read before the Institute in 1891, quoted Dr. Wallace, of Glasgow, who stated that he had known a case where coal exposed outside for three months lost 50 per cent. of its value. When different observers obtain such contrary results, it must surely be due to the difference in the class of coal; and it therefore behoves each engineer to test the matter for himself, in its bearing upon the particular varieties of coal he is in the habit of using.

This being the case, and bearing in mind the increased stocks which it is desirable to hold in the future, the question presents itself as to how far, if at all, it is necessary to go in the provision of covered stores. I may here mention that, in the discussion on Mr. Chester's paper on "The Cost of Gas-Works" at our meeting in 1892, I expressed my views upon what I considered to be the generally accepted idea that it was extremely desirable to use the freshest possible coal, and, as a consequence, to be continually removing and replacing the coal in the stores. As a matter of fact, the greater proportion of the coal used in my own case is transferred direct from the railway waggons to the retorts free of any charge for labour, as the stokers can readily unload the waggons—placed at the retort-house doors—direct into their barrows. Under these conditions, I cannot see what advantage is to be gained by erecting large buildings at considerable cost for the storeage of coal.

I do not know whether my views upon this matter were original, but I think they were opposed to the universal practice, and to the recommendation of recognized authorities. I noticed a short time ago that Mr. James Braddock, in the course of his Presidential Address to the Manchester District Institution of Gas Engineers, advanced views which were practically confirmatory of my own; and possibly Mr. Braddock had adopted them before I drew attention to the subject. Nevertheless, the point is an important one; and it will, I have no doubt, occasion a good discussion, because I do not expect that everyone will agree with me.

I come now to the question of the retort-house. The settings in the older portion of the house consist of twelve beds of six retorts, 17½ in. by 13½ in., and 9 feet long; and the firing is on the ordinary direct plan. In the newer portion of the house, there are eight beds of nine retorts, 21 in. by 14 in., and 9 feet long, fired by Siemens regenerative settings. These furnaces, I may here remark, have been much improved by myself and others; and they will, I think, compare favourably with other systems, both in first cost and in the results obtained. Previous to the introduction of the regenerative furnaces, the coke used for fuel exceeded 50 per cent. of the quantity made; whereas now, taking the year's working, and including the ordinary furnaces, the amount of fuel used has been reduced to 16·28 per cent., or 10 lbs. of coke per 100 lbs. of coal carbonized—thus leaving 10½ cwt. of coke per ton for sale.

As to through retorts, I may say that these were tried on several occasions, but no advantage was derived from their use. On the other hand, it was found that, apart from other considerations it was most inconvenient, in putting on a bed of nines, to be required to either add four men on twelve hours, or six men on eight hours; and the same thing would apply in letting down a bed. Now, when it is considered that in summer there are only about 12 stokers on, and in midwinter about 36, it becomes apparent that one through bed is too much to start or let down; and I do not think that through retorts are desirable for small or moderate-sized works, even if, indeed, they are for the largest works. In this connection, I may say that we know nothing of trouble from deposits of naphthalene. So far the charging and drawing have been done by hand, with the shovel and rake; but in the new works now under construction, I am making provision for the introduction of machinery.

Having, as it were, cleared the ground for the consideration of the results obtained, I will now ask you to bear with me while I endeavour to show, on definite lines, what I have been able to accomplish in the manufacture of gas, enriching with cannel; and I purpose comparing my experience with the published statements of others, and with the cost of enrichment by this and other means. The methods of enrichment now in use come under one of the following heads: (1) Cannel. (2) Addition of hydrocarbon vapours to the gas—*e.g.*, carburine. (3) Oil gas. (4) Carburetted water gas.

I do not propose to enter into the question of the relative merits of the three last-named methods, as the technical literature of the past few years has to a very large extent been devoted to the subject. The various processes have been adopted in different works throughout the country; and the practicability of enriching by any of them has been fully demonstrated—thereby making it clear that cannel is not now, as it was formerly, the only enriching material at our disposal. This is still another example of the wonderful elasticity of our business. While it may not be expected that any one process will entirely supersede the other, still it becomes a question as to how far each one method may entirely supersede another for particular works; and it also affords the opportunity for a combination of the processes, the choice of which will depend upon the situation of the works in relation to the cannel-fields, the seaports, and the illuminating power required. While, therefore, admitting the value of these processes under certain conditions, I think it is opportune that the position of cannel should be reviewed.

Professor Vivian B. Lewes, F.I.C., F.C.S., stated, in his paper read at the meeting of the Institute in 1891, that the relative cost of enrichment of a 16-candle coal gas up to 17·5 candles was as under—

By Cannel (Livesey) . . .	4·00d.	= 2·667d.	per candle	per 1000 ft.
„ Pintsch gas	3·64	= 2·427	„	„
„ Oil gas (Foulis)	2·34	= 1·560	„	„
„ Maxim-Clark process . .	1·64	= 1·093	„	„
„ Carburetted water gas. .	1·01	= 0·673	„	„
„ Tatham process (probable)	0·91	= 0·607	„	„
„ „ „ (claimed)	0·50	= 0·333	„	„

Again, in 1893, in his paper read before the Institute, Professor Lewes gave the cost of enrichment by means of the Lewes carburetted hydrogen gas (a mixture of hydrogen, water gas, and oil gas) as 0·5d. per candle per 1000 cubic feet; this cost being the same as with the Young process. Now, these statements as to cost, coming from so high an authority as Professor Lewes, will naturally carry great weight; and, while they may be perfectly correct so far as London is concerned, it is

TABLE *showing the Working Results at the Wallasey Gas-Works for the Eleven Years ended March 25, 1894.*

—	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.
Gas made, as per station meter . . . cub. ft.	80,539,570	91,537,310	98,394,250	105,853,400	113,040,400	123,019,800	125,283,600	147,656,600	149,515,000	159,827,000	169,649,500
Gas sold to private consumers . . . „	66,707,250	71,555,000	79,769,400	86,680,000	96,770,000	97,658,300	105,273,000	119,504,100	120,586,800	127,456,400	135,118,700
Gas sold for public lighting (including docks) . . . „	8,962,065	9,765,396	10,925,184	11,222,064	11,474,412	12,143,944	13,047,679	14,525,045	15,380,947	16,687,973	17,712,209
Gas used on the works . . . „	1,129,700	1,354,000	1,270,100	1,329,900	1,266,000	1,278,500	1,248,400	1,413,200	1,391,100	1,540,250	1,530,300
„ unaccounted for . . . „	3,740,555	8,862,914	6,429,566	7,951,336	9,522,988	11,939,056	6,962,903	12,214,255	12,156,153	14,142,377	15,288,291
„ „ „ . . . per cent.	4·6	9·7	6½	7½	8·42	9·7	5·56	8·27	8·13	8·55	9·01
Capital employed . . .	£57,339	£66,690	£66,527	£68,562	£67,131	£65,650	£66,116	£64,829	£63,139	£86,934	£92,193
„ „ per ton . . .	£7 8 0	£7 8 5	£7 1 10	£6 15 6	£6 3 0½	£5 17 7	£5 18 8	£4 13 1	£4 13 4	£6 1 9	£6 4 6
„ „ per 1000 cubic feet of gas sold . . .	15/2	16/1¾	14/5½	14/-	13/-	11/9	11/2	9/7	9/2½	11/11	11/11¼
Coal carbonized—Common . . . tons	1,414 } 7,745	2,233 } 8,988	6,477 } 9,382	5,842 } 10,180	5,322 } 10,912	5,707 } 11,162	6,933 } 11,138	9,857 } 13,930	10,372 } 13,531	11,379 } 13,877	12,388 } 14,810
„ „ Cannel . . . „	6,331 }	6,755 }	2,905 }	4,338 }	5,590 }	5,455 }	4,205 }	4,073 }	3,159 }	2,498 }	2,422 }
Average cost of mixture per ton . . . „	11/1	11/3	13/3	11/8	11/3	11/-	13/6	17/10	18/6	17/8½	16/1
Illuminating power required by Wallasey Improvement Act. candles	14	14	14	14	14	14	14	14	14	14	14
„ „ supplied . . . „	19·73	19·36	19·62	20·56	20·30	20·37	20·10	19·40	19·16	19·42	19·39
Gas made per ton . . . cub. ft.	10,398	10,184	10,486	10,397	10,345	11,021	11,248	10,600	11,050	11,517	11,454
„ sold „ „ . . . „	9,770	9,047	9,802	9,617	9,370	9,837	10,623	9,723	10,151	10,498	10,422
„ „ per cent. on make . . .	94·00	88·83	92·71	92·50	90·45	89·25	94·44	91·73	91·87	91·15	90·99
„ used at gas and water works and in offices, per cent. on make	1·40	1·47	1·29	1·25	1·12	1·04	0·99	0·96	0·93	0·96	0·90
Coke made . . . tons	5,400	6,291	6,567	6,576	6,547	6,697	6,683	8,358	8,118	8,566	8,886
„ used for fuel . . . „	2,725	2,855	3,038	3,096	2,441	2,280	2,521	1,442	1,988	1,394	1,444
„ „ „ per cent. on make . . .	50	45	46	47	37	34	37·72	17·25	24·49	16·28	16·25
„ „ „ per 100 lbs. of coal carbonized . . . lbs.	35·10	31·70	32·30	30·40	22·30	20·40	22·50	14·70	14·50	10·00	9·75
„ sold per ton of coal . . . cwts.	5·60	7·29	6·66	6·71	6·84	7·25	7·40	10·00	9·06	10·50	10·50
Average price of coke sold . . .	5/8¾	5/9½	6/8¼	7/7½	7/0½	7/3½	8/9½	8/10	7/2½	7/5	10/7½
Tar made . . . tons	701	737	823	987	1,033	982	990	981	1,047	1,169	1,167
„ „ per ton of coal . . . gallons	18·00	16·40	17·50	19·38	18·93	17·60	17·79	14·08	15·48	16·83	15·76
Average price of tar per ton . . .	51/2	38/2	20/3	11/11	13/6	20/9	27/11	28/-	26/2	16/4	16/4
Liquor made . . . tons	1,035	1,070	1,307	1,664	2,163	1,676	1,831	1,966	1,773	2,014	2,163
„ „ per ton of coal . . . gallons	29·25 (5°)	26·2 (6° & 6½°)	30·5 (5° & 6°)	35·78 (5°)	43·6 (5°)	33·03 (5°)	36·17 (5°)	31·05 (5°)	28·83 (5°)	31·93 (5°)	32·13 (5°)
Average price of liquor per ton . . .	23/4	16/11¼	11/5½	8/6	10/1	11/2½	11/4	11/5	11/5	10/5½	12/5½
Net proceeds of coke and other residuals, per cent. on the cost of coal	81·00	63·90	40·50	43·00	49·51	56·00	56·00	39·00	40·50	38·00	46·16
Required for interest, &c., per 1000 cubic feet sold* . . .	10·18d.	10·26d.	10·5d.	11·9d.	11·1d.	10¾d.	9¾d.	8·4d.	8·3d.	7·9d.	9·8d.
Number of consumers (*i.e.*, accounts) . . .	..	2,527	2,846	2,855	2,911	3,036	3,308	3,456	3,655	3,747	3,953
Net cost of gas per ton . . .	5/11	7/10	11/3	10/6	10/1	9/5	10/8	15/9	16/8	16/5	14/2
„ „ per 1000 cubic feet made . . .	6¾d.	9¾d.	1/0¾	1/-	11¾d.	10¼d.	11¼d.	1/6	1/6	1/5	1/4¼
Number of lamps . . .	..	523 } 683	525 } 685	542 } 702	576 } 736	622 } 780	580 } 843	756 } 919	839 } 1,013	920 } 1,092	950 } 1,129
		160 }	160 }	160 }	160 }	158 }	163 }	163 }	174 }	172 }	179 }
Cost of enriching gas 1 candle, per 1000 cubic feet . . .	0·120d.	0·250d.	0·792d.	0·258d.	0·144d.	0·032d.	0·342d.	1·396d.	1·388d.	1·191d.	1·060d.

* Including contributions to the sinking and depreciation funds.

scarcely fair to adopt them as standards of comparison for the country generally.

Subsequently, Mr. F. Livesey stated, at the meeting of the Southern District Association of Gas Engineers and Managers in November, 1893, that ½d. per candle per 1000 cubic feet was the lowest figure at which coal gas had been carburetted. Again, Mr. J. Ferguson Bell stated, in his paper read at the recent meeting of the Institution of Gas Engineers, that he can enrich with petroleum spirit at 1·2d., with carburine at 1·5d., and with benzol at 0·75d. per candle per 1000 cubic feet. It must not, however, be overlooked that the gas carburetted at the lowest cost is not always the cheapest. For instance, if a high quality of coal at a comparatively high price is used, it will not cost so much for carburetting; but the gas may cost more into the holder than if a poorer quality of coal at a cheap rate had been used, which required rather more cost in carburetting. The main question, therefore, is: At what cost can a given quality of gas be produced? So far as my experience goes, I should answer that 20-candle gas carburetted with cannel, can be produced at an average net cost of 1s. per 1000 cubic feet.

The following figures show the cost of enrichment for a number of years at the Wallasey Gas-Works:—

Cost of Enriching Coal Gas One Candle per 1000 *Cubic Feet with Cannel.*

1884 . . 0·120d.	1888 . . . 0·144d.	1892 . . . 1·388d.
1885 . . 0·250	1889 . . . 0·032	1893 . . . 1·191
1886 . . . 0·792	1890 . . . 0·342	1894 . . . 1·060
1887 . . . 0·258	1891 . . . 1·396	

It will be noticed that enrichment by cannel has been carried out at a cost of from 0·03d. to 1·4d. per candle per 1000 cubic feet. At the present time, the cost is at the rate of 0·76d., or ¾d. per candle per 1000 cubic feet; and this figure contrasts very favourably with the various oil enrichment processes mentioned by Professor Lewes and others. It certainly puts a different complexion on the figure for cannel; and if my paper serves no other purpose, it will, I believe, place the question of cannel enrichment on a more generally acceptable footing.

The selection of cannel is a matter that requires very careful consideration, as it has an important bearing upon the results. I may say that I have had occasion to make a selection from qualities offered at prices ranging from 9s. up to 43s. per ton (delivered), not to mention Australian at about 8os. per ton. As the candle power of the gas increases, the range of cannels becomes more restricted; so that whereas, for works supplying 16 to 18 candle gas, there may be a varied assortment of cannels in the market, when the gas has to be sent out at a higher value than this, it is better, in my experience, to use only the highest class cannels. If the sperm values of the first, second, and third class cannels are worked out per unit of (say) 10s., it will perhaps be found that the higher class is fully

as cheap as, or in many cases cheaper than, the lower; and then it must be borne in mind that, as considerably less of it is required, the resultant coke will be of better quality. On the other hand, if, for instance, 50 per cent. of a common and so-called cheap cannel be mixed with 50 per cent. of coal, the coke obtained will be of an inferior quality. It will not be so serviceable for heating the retorts, it becomes a drug in the yard, and will have to be disposed of at a cheap rate to dissatisfied customers.

The above remarks are to be regarded as true in a general sense only; for, in some cases, it may happen that a cheap cannel forces itself upon a particular works, even at the risk of having to almost give the coke away. Again, there are certain cannels which contain varying quantities of "band," or shale; and it is very important to ascertain the amount of this "band" in the sample submitted, so that the quality of the cannel may be checked from time to time by laboratory tests. I have had a very striking instance of the effect of this "band" on the quality of cannel. I had samples of the cannel very carefully picked by hand, and tested in my laboratory. The results obtained showed that the cannel, when quite free from "band," was of a very high class quality; on the other hand, the "band" was very much inferior—yielding a coke that was useless, and the sperm value was only 29·15 per cent. of that of the cannel free from "band." However, this cannel mixed with "band" in the proportion usually received (about 30 per cent.) gave good results; and the mixed coke was saleable. It thus behoves us not to be too dogmatic in our treatment of this as well as other questions; and, moreover, it indicates the necessity of having, as managers of gas-works, a class of men alive not only to the technical requirements of their profession, but also to the commercial interests thereof.

An important point, and one which is, I venture to think, often overlooked in considering the yield and the illuminating power of gas from coal or cannel, or different mixtures of the same, is that the results obtained in winter will be very much below those obtained in summer. From tests of practical working under ordinary conditions, I have found the loss in pounds of sperm per unit of 10s. in winter as compared with summer to be as 451·16 : 407·73, or 9·6 per cent.

Accompanying this paper is a table showing the working results obtained at the Wallasey Gas-Works for the eleven years ended March 25, 1894; and I venture to think that some very interesting deductions may be made from its perusal. The table speaks for itself; but perhaps some points call for special remark. It will be seen that, in 1884, 19¾-candle gas was put into the holder at 6¾d. per 1000 cubic feet; the average price of the mixture of coal and cannel being then 11s. 1d. per ton. At the same time, high prices were being received for residuals—viz., 51s. 2d. per ton for tar, and 23s. 4d. per ton for ammoniacal liquor; so that the net amount received for residuals reached 81 per cent. on the cost of coal.

This striking instance serves to show the possibilities of coal gas manufacture. At the same time we must look at the other side of the picture, and, in doing so, come to the year ended March 25, 1892, where our 19·16-candle gas—the lowest in the list—cost 1s. 6d. per 1000 cubic feet into the holder. The average price of the coal and cannel mixture was 18s. 6d. per ton; and the prices for tar and 5° Twaddel ammoniacal liquor, 26s. 2d. and 11s. 5d. respectively, or practically one-half of what they were in 1884. The net amount received for residuals was 40·5 per cent. on the cost of coal, or exactly one-half of what was received in 1884. This seems to be the high-water mark of the cost of cannel enrichment—*i.e.*, at the works in question.

Of course, in comparing these results with others, corrections will have to be made for the particular position of each works in relation to the coal-fields. Those which are situated closer to them should save something on these figures; while those that are farther away will have to add something for extra freight. An allowance should also be made for size of works; large buyers being able to make more favourable purchases than smaller ones.

A word on the question of leakage. I have found by regular testings—extending over a period of twelve months—that in the temperatures at the station meter and gasholder outlets there was such a difference as amounted to a loss of 1·7 per cent. of the gas registered by the meter; and I would further submit that, as the Sales of Gas Act allows a margin of 2 per cent. fast and 3 per cent. slow, it is only fair to take credit for ½ per cent. loss in consumers' meters—this being the mean between the two limits. I mention these points on leakage as being in addition to others that will occur to the minds of all. In my own case, the so-called leakage or unaccounted-for gas is not excessive, considering that we have 50 miles of mains, many with a small consumption per mile.

Briefly, the results obtained for the year 1893 (as shown in the table) are: 11,517 feet of 19·42-candle gas, 12 cwt. of coke, 16·83 gallons of tar, and 31·93 gallons of 5° ammoniacal liquor per ton of coal.

No two gas-works are circumstanced exactly alike. It is therefore only just, as I have previously remarked, that proper allowance should be made for the special surroundings of any one works which apparently compares unfavourably with another; and this comparison can only be properly made by experienced persons. That improper comparisons are often instituted is a well-known fact. I should therefore like to state that my paper has not been written with any intention of making invidious distinctions, but rather with a view of submitting a plain statement of actual experience, which, by eliciting friendly discussion and criticism, might advance in some slight degree the industry with which we are connected. So much having been said on the subject of enrichment schemes, it is quite refreshing to be brought face to face with the question of the total abolition of enrichment; and it is worthy of note, as Professor Lewes remarked recently, that, as in the case of Edinburgh, London, and Paris, as the candle power of the gas decreases, the effective illumination increases, owing to the larger burners in use with the lower quality of gas. Whether or not this will be carried out in the future, it is impossible to say. But it is a comfort to feel that, if the cannel supply be used up, we have alternatives at hand; and even if oil were to fail us, we should not be worse off than they are in Paris, and while we should have a gas of less illuminating power than we had been accustomed to, we should at the same time be furthering its use for other purposes than lighting, and so be nearing the oft-talked-of goal of Smokeless London.

THE APPLICATION OF COAL TAR FOR MAKING GAS.

By C. Stafford Ellery, of Bath.

The extreme fluctuations that have taken place in the tar trade during recent years, and the low prices now ruling for the products of distillation, afford ample evidence that the market stand in need of fresh outlets for at least some portion of the tar. This necessity is becoming more urgent year by year, because of the continued increase in the quantity of coal carbonized in processes of which tar is a residual product. Some figures taken from the parliamentary returns as to gas undertakings will make this clear. In the year 1882 the quantity of coal used in the gas-works of the United Kingdom was 6,365,300 tons; in the year 1892, it was 11,219,300 tons—showing an increase in ten years of 4,854,000 tons. Estimating the yield of tar at 1 cwt. per ton of coal, it follows that the production in 1882 would have been about 318,264 tons; and in 1892, 560,964 tons—an increase in ten years of about 242,700 tons.

Indications are not wanting that this rate of increase will continue. Gaseous fuel seems to be superseding coal for domestic and commercial purposes. The economy and convenience, not to speak of the avoidance of smoke and soot, which result from the use of gas engines, stoves, and fires, tend to develop a larger consumption of coal for gas-making purposes, and consequently augment the production of tar. Unless, therefore, some methods are devised to lessen the pressure to sell, the prospect of any substantial improvement in the price of tar seems to be very remote.

In looking for relief, attention is naturally directed to the existing applications of coal tar. Of these, distillation obviously stands first. But the trade reports of tar products do not encourage much hope of any developments likely to remove the cause of depression. Of the employment of tar without distillation—such as in the preparation of asphalte and roofing felt, or as a paint in the preservation of wood, iron, and building material—little need be said

in this paper. The quantity thus utilized being comparatively small, mention is mainly made in the hope that some fresh hints may be drawn from the experience of those who possess special knowledge of such industries.

Relief has been sought, at times of extreme depression, by utilizing some portion of the production for fuel. This effected the one result of temporarily relieving a glutted market; but there are grounds for the contention that to burn a valuable "complex mixture of chemical compounds," as tar has been well called, simply to clear it off the market, is, to say the least of it, an extravagant proceeding. It further involves great anxiety and worry in controlling furnaces and securing regular and complete combustion, besides throwing the unused coke on to a market already fully supplied.

At this point, it may be well to give the percentage of products obtained from a sample of ordinary tar:—

	Per Cent.
Ammoniacal liquor, gases, and loss	9·2
Light oils	1·4
Second light oils	1·6
Creosote oils	20·5
Anthracene oils	6·9
Pitch	60·4
	100·0

This analysis cannot be relied upon for other than the particular sample tested. On the contrary, the composition of tar will be found to vary not only in different works, but also in the same works if taken at different parts of the plant or under altered conditions. The coal may have something to answer for in this matter; but the point emphasized here is that in most cases tar contains more or less of the valuable hydrocarbons shown in the analysis, which, in the author's opinion, should be put to a better use than providing fuel for furnaces.

In the year 1880, Mr. Greville Williams gave, as the result of a series of experiments, the startling fact that gas, in passing through a tower filled with clinkers saturated with tar, was injured to the extent of 2 candles. Admitting that the illuminating power of gas is not injured to this extent in the ordinary process of manufacture, it will probably be conceded that, in some works at least, the tar is, to a greater or less degree, further enriched, at the expense of the gas, on its passage through the foul mains. It would be rash to fix any exact proportion; but in most tars as sold there would probably be little short of 40 per cent. of compounds capable of conversion into illuminating gas. It will also be noted that a considerable quantity of ammonia is present. This clearly is lost to the gas company, whether the tar be sold or used as fuel.

These considerations lead to the question whether it may not be both desirable and profitable at all gas-works to utilize a portion, and in the case of some works the whole, of the tar produced, as a substitute for coal in the manufacture of gas. Few gas managers have, at one time or another, escaped the fascination of this idea of gasifying tar; and yet, though good work has been done, and interesting information published—notably in connection with the Peebles process—little seems to have been effected beyond the experimental stage. The results embodied in this paper represent merely what has been accomplished at one works; but the author desires to make quite clear his opinion that very much yet remains to be found out. With this idea in his mind, he consented to open a discussion to-day among those who are working in the same field of research, in the hope that thereby the desired end may be more speedily reached. To narrate all the experiments, failures, and disappointments, would occupy too much time. Suffice it to say that a large number of tests were carried out before the stage was reached which is described in this paper.

The apparatus employed is a small plant erected for testing coals. Several forms of retorts were tried; but most of the work has been done in a Ω-shaped iron retort, 18 in. by 14 in., and 9 feet long. It may, and probably will be, that further experience will suggest modifications; but up to the present it has been found convenient to conduct the experiments with plant suitable for carbonizing either coal or tar, as occasion required. The retort is set at an angle, having a fall of about 3 inches from front to back; and a sloping tile is fitted on the mouthpiece, to prevent any accumulation of tar behind the lid. The ascension-pipe was originally connected with a dip-pipe, to a seal-box, which served the place of a hydraulic main. After a time, this seal-box was dispensed with, and the pressure in the retort regulated by means of a governor attached to the exhauster engine. The condenser is a simple series of pipes fixed on brackets against the retort-house wall, having a slight inclination throughout, so that all products of condensation return to the retort. The exhauster is placed between the condensers and washer; and after passing this and the purifier, the gas is measured in a station-meter and stored in a special holder.

It was soon discovered that the destructive distillation of tar could not be successfully carried out in a single operation. The effect of subjecting tar to a heated surface is to liberate not only gas, but a more or less considerable quantity of oils, according to the internal temperature of the retort. Experience shows that these oils are capable of producing the richest gas. The plant is accordingly arranged so that all condensed vapours gravitate back to the retort, and that without coming to rest in the hydraulic main or syphons, because of the tendency of some of the paraffins to solidify if permitted to fall below a certain temperature.

All the tar used is measured from a small store-tank, fitted with a float having a graduated stem. In the earlier tests, the tar was run into the front of the retort through a ¾-inch tube, connected into the ascension-pipe. The oils passed in the same way. The effect of this was to lower the temperature in the front of the retort where the two streams flowed in; whilst it was unduly high at the back. To correct this, the tar is at present run in at the back end of retort; and a portion of the oils continues to flow down the ascension-pipe. This works satisfactorily so long as the stream of tar is regulated to produce oils in sufficient quantity at the top of the ascension pipe. If the inflow of tar is insufficient, free carbon is produced, with most unpleasant results—stopped pipes, with all their attendant evils in most aggravated forms. This trouble is also experienced if the tar or oils are brought into sudden contact with an overheated retort. It has been obviated by throwing a few pounds of dust coal into the retort before running in the tar. Water also has been used in conjunction with the tar; and it is a question whether superheated steam or water will not ultimately play a more important part in this process.

There remains yet the commercial side of the subject. Sufficient has been said to show that the yield of gas will vary between extremes somewhat widely separated. When these experiments were commenced, the quantity of gas produced was small and of inferior quality. For long months, it looked as if 10,000 cubic feet was the best obtainable from a ton of tar; but later returns have improved, so that the yield has reached as much as 20,000 cubic feet. But in no case could such illuminating power —25 candles—be obtained as is reported from experiments elsewhere. The difference is possibly to be found in the quality of tar. Taking the average of a large number of tests, it may be assumed than an ordinary sample of tar will yield at least 16,000 cubic feet of 15-candle gas per ton of 200 gallons. In addition to gas, the destructive distillation of tar results in two other products, coke and ammoniacal liquor. The coke is practically free from ash; and, if produced at a proper temperature, it should be equal to best foundry coke. The quantity varies, but may safely be set down at 10 cwt. per ton of tar. The ammonia is estimated as equal to the production of 16 lbs. of sulphate of ammonia per ton of tar. Various methods may be adopted for arriving at a fair valuation. The following figures are based upon the values obtaining at the works where the experiments are being conducted; but prices will doubtless vary in different localities. It is hoped that sufficient data are given in the paper to enable others to arrive at a valuation after having analyzed the tar to be used. To get at the money value per ton of tar:

16,000 cubic feet of gas are taken, at 9d. per 1000 feet	= 12s.
Ammonia	(say) = 1
Coke 10 cwt., taken at 16s. per ton	= 8
	21s.

Assuming 21s. as the present value of tar if used for gas making, and taking 15s. as the market price of tar, there is a margin of 6s. per ton in favour of applying it to the manufacture of gas.

But other and larger considerations must be taken into calculation. By using up some portion of the production in this manner, the market would be relieved, and prices of

the tar and other products should return to something nearer their true value. The coal market also would be affected, more or less, according to the extent to which this employment of tar is carried. Assuming that one-half of the tar produced was converted into gas, the effect would be to throw 400,000 tons of coal on to the market.

To those gas-works more or less distant from any tar distillery, also to small works without convenient railway accommodation, the application of tar to the manufacture of gas should have special interest. In these cases, carriage is a heavy item of expenditure; and it renders the tar almost unsaleable, or at best a source of very small revenue. In such places, considerable advantage would be derived from converting the bulk of the tar into gas. Further, if tar was thus employed, a door might be opened for some modification in the present method of carbonizing coal. As hinted at by the author at the meeting last year at Belfast, "high heats" are adopted in order to avoid the loss of hydrocarbons which otherwise would be taken away in the tar. The result frequently of carbonizing at such high temperatures, is the separation of free carbon, as is evidenced by stopped pipes and scurfed retorts. If the tar was re-used for the production of gas, it might be advantageous to work retorts at a lower temperature, and produce a richer tar, which would be useful as a substitute for cannel coal or other enricher.

Although the conclusions arrived at in this paper are based on figures obtained in a special apparatus with an iron retort, it may be of interest to state that, during the later months of last year, some tons of tar were carbonized in the ordinary clay retorts. The tar was run down the ascension pipe on to a fire-clay tile fitted in the mouthpiece to prevent any accumulation of tar behind the lids; and it was possible to burn off a charge of about 40 gallons in six hours. As a makeshift, when coal was scarce, this was continued a short time; but for economical working iron retorts are desirable; and these should be fitted with sufficient condensing power to ensure the return of the oils which escape from the retorts only partially decomposed.

In conclusion, it may of interest to state that experiments have been made, and are being continued, to determine, first, the effect of passing a stream of coal gas through the retort in which the destructive distillation of tar is taking place; and, second, to ascertain the result of returning to the retort all the tar produced from an ordinary charge of coal, so as to gasify this product as well as the coal before the coke is withdrawn. Though no figures can be given at this stage of the investigation, yet sufficient evidence has been already accumulated to warrant the confident belief that more will be done with tar than has yet been accomplished; and at a future meeting it may be interesting to take up this subject for further discussion.

CONSTRUCTION AND WORKING OF REGENERATOR SETTINGS OF RETORTS.

By W. R. Chester, of Nottingham.

The subject of gaseous firing is one which possesses a very high degree of interest to the gas engineer; for it not only opens up to him a direct road to an immediate and permanent reduction in the cost of production, but it is in itself an operation, or rather a series of operations, embodying the most fascinating attractions to the scientific mind. The application of the principle to the heating of retort-settings, both with and without recuperation, has been accompanied with almost unqualified success. To its further development, however, we owe a perfect revolution in the processes of carbonization. Gaseous firing may truly be said to have been the progenitor of the inclined retort; and whatever economical advantages are generally placed to the credit of this system of carbonization, they are primarily due to gaseous firing, which has made the inclined retort a practical possibility.

The theory of the subject has been so ably discussed in the past, and is now so well understood, that I do not propose to take up your time in going over this ground again, but will deal with the practical application of the principle, and the results which have accrued from its adoption within the experience of the writer during the past fourteen years.

It was in the years 1878-80 that the attention of English gas engineers was first generally directed to the economic possibilities of gaseous firing for heating retorts, though even at this time some of the more enterprising men had already been coquetting with the subject for two or three years previously. Long before this, however, it had become a well-recognized fact that there were enormous volumes of heat wasted in connection with the ordinary coke-fired setting, and many more or less successful attempts had been made to grapple with the difficulty. Messrs Lowe and Kirkham, with this object in view, originated the idea of combining clay and iron retorts in one setting; and the plan was afterwards further developed by Messrs. Croll and Anderson, who utilized the waste heat leaving the setting of clay retorts for heating a supplementary setting of iron retorts before its escape to the chimney. In 1875, Mr. Tindall, of Walsall, described the retort-settings he had had in operation for four or five years, in which some important economical results were obtained from heating up the secondary air supply; and in 1880 we have records of experiments made by Mr. Frank Livesey in the same direction, in which he obtained a reduction of 20 per cent. in the fuel account by heating up the secondary air supply. These continual attempts to minimize the loss of heat from retort-settings, kept the subject of fuel economy prominently before the minds of gas engineers.

The successes of Sir William Siemens in his application of gaseous firing to other industries, and the successful adoption of the principle to retort-settings by our German *confrères*, stimulated the English engineers to try their hand in the same direction. During 1880, and immediately afterwards, some of the best types of German furnaces were constructed in different gas-works throughout this country; while simultaneously a number of English engineers were carrying out experiments in gaseous firing on independent lines. Sir William Siemens modified and adapted his system of gaseous firing, then in operation in the Paris Gas-Works, to English requirements; and many settings were erected in accordance with his plans.

The next few years saw a very rapid development of the system, and many new types and variations introduced, until we now have almost as great a variety of systems as formerly existed in connection with the old settings. They may, however, be grouped under three headings: (1) The simple generator, in which the solid fuel is gasified, but where no special means are employed for heating either the primary or the secondary air supply. (2) The generator supplemented with the "regenerator," by which the secondary air supply is raised to nearly the temperature of the producer gases. (3) The generator with provision for heating both the primary and the secondary air supply.

As illustrating the first type, we have the settings erected by Mr. Valon at Ramsgate and Mr. Carpenter at Vauxhall, who have each championed in public their respective installations. The theory upon which the argument for these settings was based, and with which Mr. Valon staggered the Institute in 1884—viz., "that dry air is incapable of being heated beyond a very limited extent in its passage through heated channels of brickwork," and its consequent—"that regenerators were therefore superfluous, and their construction involved an unnecessary waste of money," was proved to be untenable. Professor Harold B. Dixon, M.A., demonstrated the fact, in a very beautiful and conclusive experiment, that air rapidly absorbed heat, and that in passing over heated surfaces it became raised in temperature approximating closely to that of its surroundings; thus clearly proving the utility of the regenerator, and even its necessity, if high economical results were to be achieved. When it is possible to obtain a whole loaf at the same cost as the half, there will be few who will be content with the latter quantity; and consequently, though the simple generator is a considerable improvement on the direct coke-fired furnace, it is not destined to make much progress except in cases where it is not possible to add the regenerator also.

The second type—the generator supplemented by the regenerator for heating up the secondary air supply—is the type which has found most favour in this country, and is that generally adopted in new installations.

The third type—the generator supplemented by means for heating up both the primary and the secondary air—is a development of the second type, and is to be found in operation principally on the Continent. It is doubtful whether the small additional economy in fuel to be obtained

by heating up the primary air supply is not more than counterbalanced by the increased cost of wear and tear of the generator lining. A comparatively low temperature only being necessary for the conversion of the fuel into carbonic oxide, the admission of cold air below the bars enables the temperature of the generator to be kept so low as to involve practically no wear and tear on the brickwork of which it is constructed, and also permits the mineral matter of the fuel to be removed from the furnace in the form of ash instead of clinker—a very distinct gain where high rates are paid for labour.

The generator consists of two types: (1) the inside generator; (2) the outside generator; and two subdivisions (*a*) the hearth base; (*b*) the grate base. The inside generator is placed beneath the setting, and forms the substructure for it. Being completely surrounded by the walls of the regenerator, its heat of combustion is nearly all retained and utilized; while with the outside generator, which is generally constructed in a wrought-iron casing apart from the setting, there is both a considerable loss of heat from radiation and an unnecessary heating up of the surrounding atmosphere, in which the firemen have to work under most oppressive conditions. Both inside and outside generators may have either a hearth-base or a grate-base; the former, being simpler and less expensive in its first cost, involves greater labour, however, and does not effect such perfect combustion of fuel as the second.

Having described the leading features of the various systems of gaseous firing now in operation, I will give the structural cost, and relative working results of such as have come under the personal control of the writer; taking as a basis for comparison a good type of the direct coke-fired setting.

Direct Coke-fired Setting on the Old Plan, consisting of Seven Through ⏛ Retorts, each 19 ft. 6 in. long, 22 in. by 16 in.

Structural Cost per Mouthpiece.

		Per Cent.
Excavation and foundations	£1 10 0	10·71
Walls, arches, and main flue, including buckstays and tie-rods	6 10 0	46·43
Settings above the floor-line, and within the walls, including furnace fittings—*i.e.*, fire-bars, doors, and frames	6 0 0	42·86
Total	£14 0 0	100·00

Average life of retorts, working 4·8 hour charges, 2¾ cwt. per charge	500 days.
	T. c. q.
Coal carbonized per mouthpiece during life of retort	296 17 2
Coke consumed per 100 lbs. of coal carbonized	28 lbs.
„ sold per ton of coal carbonized	6·4 cwt.
Firemen's wages per day of 12 hours (one fireman attends to five fires)	5s.

Working Cost per Ton of Coal Carbonized for Each Complete Life of Retorts.

	Per Mouthpiece.	Per Ton of Coal Carbonized.
Wear and tear charges, being—		
Original cost of setting	£6 0 0	= 5·66d.
Repairs and twice refurnacing during one life	1 0 0	
Firemen's wages		5·77
Fuel, 28 per cent. = 5·6 cwt., at 5d. per cwt.		28·00
Total		39·43d.

Or (say) 3s. 3½d. per ton of coal carbonized.

The first gaseous-fired settings working under the direct control of the writer were ten beds erected in 1882–83 to the designs of Herr Aug. Klönne, who supplied the plans and a portion of the material. The retorts were put into operation in 1884. The settings consisted of through retorts—nine in a bed, each 20 feet long (24 inch by 15 inch ⏛'s), heated by two generators, and fitted with an elaborate system of regenerators, in which were fixed four cast-iron cylindrical boilers for supplying steam to the furnaces. The generators were of the inside type, having a grate-base.

Structural Cost per Mouthpiece.

		Per Cent.
Excavation and foundations	£1 0 0	3·10
Walls, arches, and main flue, including buckstays and tie-rods	12 0 0	37·24
Generators and regenerators, including iron fittings	12 15 0	39·57
Settings above the floor-line	6 9 6	20·09
Total	£32 4 6	100·00

The settings were completely burnt out in 300 days; and it was found that the generators and regenerators were in such a bad condition as to be unworkable, and they had to be renewed from the bottom. Several sets of boilers were destroyed; and after a time these were discontinued, and the steam-pipes were coupled direct to the works' boilers.

Average life of retorts, working six-hour charges, 4 cwt. per charge	300 days.
Coal carbonized per mouthpiece during life of retorts	240 tons.
Coke consumed per 100 lbs. of coal carbonized	16·85 lbs.
„ sold per ton of coal carbonized	8·56 cwt.
Steam consumed in furnaces per ton of coal (equivalent to 8 lbs. of coke)	40 lbs.
Firemen's wages per day of 12 hours (one fireman attends to ten fires, clinkering five fires each day)	5s.

Working Cost per Ton of Coal Carbonized for Each Complete Life of Retorts.

	Per Mouthpiece.	Per Ton of Coal Carbonized
Wear and tear charges, being—		
Original cost of generator and regenerator	£12 15 0	= 19·23d.
„ „ setting	6 9 6	
Firemen's wages		1·67
Fuel { 16·85 per cent. for furnaces, 0·35 per cent. for steam } = 3·44 cwt., at 5d.		17·20
Total		38·10d.

Or (say) 3s. 2d. per ton of coal carbonized.

The cause of the rapid destruction of these settings was due to the material fusing at the point where combustion takes place. The cause of the failure of the generators was due to complete combustion of the fuel in them whenever the back end of the fire became short of coke. The coke at this point was only about 12 inches deep when the fire was filled up. The failure of the regenerators was due to short-circuiting of the producer gases, through crevices in the walls of generators, which were in consequence overheated. The utmost care was exercised in working the settings; but these weak places were beyond the control of the operator when once the settings were put into work.

The next settings started under the control of the writer were five beds, also erected in 1882-83, and put into operation in 1885. They were constructed to the designs of the late Sir William Siemens, and erected under his supervision. The settings consisted of through retorts 20 feet long—nine in a bed (24 inch by 15 inch ⏛'s) heated by a single outside generator and an elaborate system of regenerators.

Structural Cost per Mouthpiece.

		Per Cent.
Excavation and foundations	£1 0 0	3·96
Walls, arches, and main flues, including buckstays and tie-rods	12 0 0	47·53
Generator and regenerator, including ironwork	7 15 0	30·69
Settings above floor-line	4 10 0	17·82
Total	£25 5 0	100·00

The settings began to fail after three weeks; the arches under the bottom retorts giving way where combustion takes place. These bottoms of the retorts were afterwards blocked up with piers, and the settings worked for 104 days, when the regenerator flues gave way and allowed the whole settings to collapse. The lower portion of the regenerators was constructed of common red building bricks, on the assumption that the temperature of the waste gases would be lowered to such an extent as to leave no influence on these bricks. The common bricks were, however, melted; and hence the destruction of the regenerators and the settings also. The linings of the producers had also burnt away, and the iron casing was burnt into large holes.

Average life of retorts, working six-hour charges, 4 cwt. per charge	104 days.
	T. c. q.
Coal carbonized per mouthpiece during life of retorts	83 4 0
Coke consumed per 100 lbs. of coal carbonized	16·45 lbs.
„ sold per ton of coal carbonized	8·50 cwt.
Steam consumed in furnace per ton coal carbonized (equivalent to 23·6 lbs. of coke)	118 lbs.
Firemen's wages per day of 12 hours (one fireman attends to five fires, clinkering them all)	5s.

Working Cost per Ton of Coal Carbonized for Each Complete Life of Retorts.

	Per Mouthpiece.	Per Ton of Coal Carbonized.
Wear and tear charges, being—		
Original cost of generator and regenerator	£7 15 0	= 35·34d.
„ „ setting	4 10 0	
Firemen's wages		3·33
Fuel { 16·45 per cent. for furnace, 1·05 per cent. for steam } = 3·50 cwt., at 5d.		17·50
Total		56·17d.

Or (say) 4s. 8¼d. per ton of coal carbonized.

The third series of gaseous-fired settings were five beds, also erected in 1882-83, and designed by our President, Mr. West, who at that time was Chief Engineer to the

Corporation of Manchester. The settings consisted of nine retorts in a bed—each 20 feet through (24 inch by 15 inch Ω's), heated by two inside generators, with grate-base and regenerators constructed of plain bricks and tiles.

STRUCTURAL COST PER MOUTHPIECE.

		Per Cent.
Excavation and foundations	£1 0 0	3·87
Walls, arches, and main flue, including buckstays and tie-rods	12 0 0	46·42
Generators and regenerators, including iron fittings	7 10 0	29·01
Settings above floor-line	5 7 0	20·70
Total	£25 17 0	100·00

These settings were constructed with a better proportioned brickwork, and with a special quality of silica brick in and around the combustion chamber. They worked for 406 days continuously, without repairs, and would have gone much longer except that the mouthpiece bolts gave way, and the upper division walls of the regenerators failed through becoming over-heated by producer gases short-circuiting through crevices in the generator walls. The generators and the regenerators were found to be in good condition when the settings were let down, with the exception of the top chamber of the regenerators, which had to be renewed.

Average life of retorts, working six-hour charges, 4 cwt. per charge	406 days.
Coal carbonized per mouthpiece during life of retorts	T. C. Q. 324 16 0
Coke consumed per 100 lbs. of coal carbonized	15·85 lbs.
Coke sold per ton of coal carbonized	8·76 cwt.
Steam consumed per ton of coal carbonized (equivalent to 8 lbs. of coke)	40 lbs.
Firemen's wages per day of 12 hours (one fireman attends to ten fires, clinkering five each day)	5s.

WORKING COST PER TON OF COAL CARBONIZED FOR EACH COMPLETE LIFE OF RETORTS.

	Per Mouthpiece.	Per Ton of Coal Carbonized.
Wear and tear charges, being— Part cost of regenerator destroyed; Original cost of setting	£1 0 0; 5 7 0	= 4·69d.
Firemen's wages		1·67
Fuel { 15·85 per cent. for furnace; 0·35 per cent. for steam }	= 3·24 cwt., at 5d.	16·20
Total		22·56d.

Or (say) 1s. 10½d. per ton of coal carbonized.

The fourth series of gaseous-fired settings were eight beds erected 1885–86 on the Siemens system, as modified by Mr. William Foulis, of Glasgow, who has probably developed this system more than any other gas engineer. The settings consisted of nine retorts in a bed (24 inch by 15 inch Ω's), heated by two outside generators, with hearth-base and a simple form of regenerator constructed with plain bricks and tiles. The whole settings were constructed of Glenboig material; this being the material used in Glasgow, and which Mr. Foulis recommended.

STRUCTURAL COST PER MOUTHPIECE.

		Per Cent.
Excavation and foundation	£1 0 0	3·61
Walls, arches, and main flue, including buckstays and tie-rods	12 0 0	43·24
Generators and regenerators, including ironwork	8 10 0	30·63
Settings above floor-line	6 5 0	22·52
Total	27 15 0	100·00

The settings worked for 500 days, during which time the arches under the bottom retorts had to be supported by additional piers, and the producers were each relined once. The regenerators remained good.

Average life of retorts, working six-hour charges, 4 cwt. per charge	500 days.
Coal carbonized per mouthpiece during lifetime of retorts	400 tons.
Coke consumed per 100 lbs. of coal carbonized	20·15 lbs.
Coke sold per ton of coal carbonized	7·35 cwt.
Steam consumed per ton of coal carbonized (equivalent to 70 lbs. coke)	350 lbs.,
Firemen's wages per day of twelve hours (one fireman attends to five fires, clinkering them all)	5s.

WORKING COST PER TON OF COAL CARBONIZED FOR EACH COMPLETE LIFE OF RETORTS.

	Per Mouthpiece.	Per Ton of Coal Carbonized.
Wear and tear charges, being— Cost of relining producers twice; Original cost of setting; Repairs to setting	£1 0 0; 6 5 0; 0 10 0	= 4·65d.
Firemen's wages		3·33
Fuel { 20·15 per cent. for furnace; 3·12 per cent. for steam }	= 4·65 cwt., at 5d.	23·25
Total		31·23d.

Or (say) 2s. 7¼d. per ton of coal carbonized.

Summarizing the foregoing, we have the following results:—

STRUCTURAL COST PER MOUTHPIECE,

Including Everything, except the Retort-Fittings, Mouthpieces, Ascension-Pipes, and Hydraulic Mains.

Ordinary settings	£14 0 0
Gaseous-fired regenerators—	
Klönne	32 4 6
Siemens	25 5 0
West	25 17 0
Siemens-Foulis	27 15 0

WORKING COST PER TON OF COAL CARBONIZED DURING ONE COMPLETE LIFE OF THE RETORTS.

Ordinary setting	39·43d.
Gaseous-fired regenerators—	
Klönne	38·10
Siemens	56·17
West	22·56
Siemens-Foulis	31·23

Taking the best of the results from these early regenerators—viz., those obtained from the West settings, we have a first cost of £25 17s. per mouthpiece, as against £14 for the ordinary setting, or an increased cost of £11 17s. per mouthpiece. The working expenses of the ordinary setting are 39·43d. per ton of coal carbonized, as against 22·56d. for the West regenerators, or a diminution of 16·87d. per ton of coal carbonized. This figure 16·87d., multiplied by 324·8 tons of coal, gives £22 16s. 6d. as the total saving in working expenses per mouthpiece during the first life of the retorts, which is sufficient to wipe out the additional first cost of the regenerator, £11 17s., and leave a balance of £10 19s. 6d. profit per mouthpiece on the first life of the retorts. On future lives of the retorts, the saving would be proportionately greater, as the first cost—£25 17s.—includes £20 10s. for arches, walls, main-flue, generator, and regenerators, which would not require to be renewed for many lives of the settings.

Though these results fell short of what was to be expected from the application of the system, yet they clearly indicated that very valuable economical advantages might be expected from its further development. The diminution of the fuel account by 42 per cent., and of the cost for firemen's wages by 71 per cent. were satisfactory; but the rapid destruction of the retorts left much to be desired. The defects, however, were principally structural, and due to a want of practical knowledge and experience on the part of the designers in the disposition of the material with which the settings were constructed. It was quite evident that common house bricks were not good enough for regenerator flues, and that Stourbridge fire material was incapable of withstanding the intense heats of the combustion chamber. With a proper adaptation of means to ends, there appeared to be no reason why the durability of the retorts should be less in the regenerator than in the ordinary settings—indeed, with a steadier and more regular combustion of fuel, and with less liability to extreme variations in temperature, there seemed to be every reason to expect an increased durability rather than otherwise. With the aim of bringing this increased durability about, the writer reconstructed the burnt out settings, adopting the inside producer with simple brick and tile regenerators of Stourbridge material, and abandoning the bottom middle retort in the setting for a combustion chamber constructed of the best silica bricks. With these modifications, the durability of the retorts was increased by 200 working days; and the wear and tear charges were proportionately lessened, while there was also a still further diminution of the fuel account.

The reasons for the adoption of the inside producer in preference to the outside as designed by Sir William Siemens were: (1) Better control of the rate of combustion. (2) The conversion of the mineral matter of the coke into ash, instead of into clinker. (3) Diminished labour in cleaning the fires; clinkering only being done once in 24 hours, instead of every 12 hours. (4) Increased durability of the brickwork lining. (5) Greater comfort and convenience in the working.

To describe in detail the many phases through which the system has passed in the experience and practice of the writer would but weary the members of the Institute. Experiments have, however, been made with almost every type of generator, regenerator, and setting, and with almost every kind of fire-brick, with the object of selecting the most suitable, efficient, and durable material for the purpose of constructing retort-settings.

An installation of eight through settings of retorts, constructed by the writer at the Nottingham works in 1889,

was renewed last year; the cost and working results of the first life of the retorts being as follows: The settings consisted of eight retorts in a bed, each 18 ft. 6 in. long (21 in. by 14 in. ⏛), heated by two inside generators and a simple form of regenerator; the steam for the furnaces being supplied from a water-tube steam-boiler, heated by the waste gases.

STRUCTURAL COST PER MOUTHPIECE.

		Per Cent.
Foundations, walls, arches, and main flue, including ironwork	£6 18 0	40·59
Generators and regenerators, including ironwork	4 12 0	27·06
Settings above floor-line	4 10 0	26·47
Steam-boiler and fittings	1 0 0	5·88
	£17 0 0	100·00

These retorts worked continuously for 1100 days, or a little over three years, without repairs of any description.

Coal carbonized per mouthpiece during life of retorts (2¾ cwt. per charge, 4·6 charges per 24 hours)	695·75 tons.
Coke consumed per 100 lbs. of coal carbonized	12·5 lbs.
Coke sold per ton of coal carbonized	9·50 cwt.
Steam consumed per ton of coal	33 lbs.
Firemen's wages per day of eight hours (one fireman attends to 16 fires, clinkering 5½ per shift)	4s. 6d.

WORKING COST PER TON OF COAL CARBONIZED DURING COMPLETE LIFE OF RETORTS.

	Per Mouthpiece.	Per Ton of Coal Carbonized.
Wear and tear charges, being—		
Original cost of settings	£4 10 0 =	1·55d.
Firemen's wages		2·00
Fuel, 12·5 per cent., or 2½ cwt., at 5d.		12·50
Total		16·05d.

Or (say) 1s. 4d. per ton of coal carbonized.

Both the original cost and the working results of these settings show important economical advances in gaseous firing; the working cost per ton of coal carbonized being no less than 60 per cent. less than that of the ordinary setting. This is an important achievement when the smallness and the shortness of the retorts are taken into consideration. It will not be uninteresting to compare these results with those obtained from the ordinary setting.

		Nottingham Regenerator Setting.		Ordinary Coke-fired Setting.
Duration of retorts	days	1100	..	500
Coal carbonized,	tons	696	..	297
Fuel used	p. ct.	12½	..	28
Working charges—				
Wear and tear		1·55d.	..	5·66d.
Firemen's wages		2·00	..	5·77
Fuel		12·50	..	28·00
		16·05d.	..	39·43d.

By further analyzing the fuel account—the largest item in the working cost—we find that the average percentage of ash and cinders removed as refuse from the ordinary setting ranges between 27 and 48 per cent. of the coke consumed or an average (say) of 34 per cent.; while that from the generator setting is 18 per cent. A large portion of the refuse which is removed from the ordinary setting consists of cinders or unburnt coke, which in the generator is burnt and utilized. For a through setting of generators, 25·3 cwt. of coke is used for fuel in 24 hours; 20·5 cwt. being consumed, and 4·8 cwt. removed as refuse. Now if the refuse had been 34 per cent., instead of 18 per cent., we should have had to use 31 cwt. of coke as fuel, instead of 25·3 cwt., the difference (or 5·7 cwt.) representing the amount of combustible material which is utilized in the generator and wasted in the ordinary setting. This 5·7 cwt. of coke = 638·4 lbs., which, burnt to carbonic acid, yields 9,284,890 units of heat.

COMBUSTION IN GENERATORS.

	Combustible Matter.
2833 lbs. of coke (25·3 cwt.), less 18 per cent of ash refuse	2323 lbs.
2323 lbs. of combustible matter consists of—	
96 per cent. of carbon	2230 ,,
4 per cent. of hydrogen	93 ,,
876 lbs. of water vapour—*i.e.*, 779 lbs. of oxygen and 97 lbs. of hydrogen	97 ,,

Of the 2230 lbs. of carbon, 90 per cent. is converted into carbonic oxide, which is equal to 4683 lbs. carbonic oxide. Now these 4683 lbs. carbonic oxide require 2676 lbs. of oxygen for their complete combustion. The 190 lbs. of hydrogen require 1520 lbs. of oxygen for complete combustion; making a total of 4196 lbs. of oxygen, or 18,047 lbs. of air required for the complete combustion of the producer gases. To ensure complete combustion, however, it is necessary to pass about 10 per cent. more air through the regenerator than is theoretically required. This gives (say) a total of 19,851 lbs. of air, which, in passing the regenerator, is raised from 100° to 1900° Fahr., or (say) 1800°. The specific heat of air is 0·2374; and therefore the quantity of heat required to raise the temperature of 19,851 lbs. of air 1800° will be—

19,851 lbs. × 0·2374 × 1800 = 8,482,729 units of heat.

The saving effected by the regenerator setting over the direct coke-fired setting may be thus divided—

	Units of Heat.	Per Cent.
Saving due to producer	= 9,284,890	= 52·26
,, ,, regenerator	= 8,482,729	= 47·74
	17,767,619	= 100·00

We thus see that, of the total saving effected so far as fuel is concerned, roughly one-half of it is due to the generator, and the other half to the regenerator.

In the early regenerators, it will be noted that the fuel required for raising the steam necessary for the producers ranges from 0·35 to 3·1 per cent. on the coal carbonized. This steam plays a very important economical part in the working of the setting. Its decomposition lowers the temperature of the primary combustion to just what is necessary for the conversion of the solid fuel into carbonic oxide gas; and in thus lowering the temperature, it not only has the effect of materially prolonging the life of the producer, but it prevents the mineral matter in the coke from being fused into clinker, and enables it to be removed in the form of ash; thereby greatly facilitating the work of the fireman. This lowering of the temperature of primary combustion does not involve any waste of heat, since, whatever heat may have been abstracted in the decomposition of the steam in the producer where heat is not required, it is all re-developed in the setting where the heat is wanted; the hydrogen from the decomposed steam giving out as much heat on its combustion as was absorbed in its decomposition.

The steam found by the writer most beneficial in the working of the producer is about 32 lbs. per 100 lbs. of carbon consumed, or 3·70 lbs. of water per 100 lbs. of coal carbonized, which, if raised in the ordinary boiler, will require 12 cwt. of coke per day for eight through settings, the cost of which, at 10s. per ton, will amount to 42s. per week. This steam was formerly all supplied from the works' boiler; but the writer, noting that the annual cost amounted to a considerable sum, devised a water-tube boiler for raising it from the waste heat of the gases leaving the settings. Sufficient heat leaves the settings to evaporate 1000 gallons of water per day, the steam from which is all utilized under the furnaces, except the small amount used for driving the feed pump of the boiler. The cost of the boiler and fittings is about £128, or £1 per mouthpiece on the retorts; while the annual saving amounts to £109 4s. per annum. A drawing of the boiler is exhibited on the screen.*

The most recent installation of gaseous-fired regenerators constructed by the writer are some completed last year at the Basford Gas-Works of the Nottingham Corporation. They consist of ten beds of through settings—eight retorts in a bed, each 20 feet long (22-inch by 16-inch ⏛), capable of carbonizing 4 cwt. of coal per mouthpiece in five-hour charges. The cost of the installation, including excavation below the floor-line and all fittings, is—

COST OF TEN BEDS OF REGENERATOR SETTINGS ERECTED AT THE BASFORD GAS-WORKS.

	Total Cost.	Cost per Mouthpiece.
Excavating below floor-line of retort-house, underpinning retort-house walls and making approaches	£618	£3·86
Foundations for retort-stack	160	1·00
Walls, arches, and main flue of settings including ironwork	1250	7·81
Producers and regenerators up to floor-line, including ironwork	1183	7·39
Retort-settings above the floor-line and within the walls	1200	7·50
Retort fittings, mouthpieces, ascension-pipes, hydraulic mains, weir valves, and relief main	1950	12·19
Water-tube steam-boiler and fittings	160	1·00
Cellar floor	94	0·59
Retort-house floor, including girders and floor plates	885	5·53
Total	£7500	£46·87

Cost = £750 per bed, or £46·87 per mouthpiece, which is rather less than £50 per ton of coal carbonized per day.

The structure is a very substantial one, built to last a generation; the first cost being only a secondary consideration compared with prolonged durability and low cost of working.

* An illustration of the arrangement here referred to was given in the JOURNAL for Dec. 9, 1890 (p. 1191), when publishing the paper, on "The Supply of Steam to Regenerator Furnaces, and the Utilization of Waste Heat for Raising the Same," read by Mr. Chester before the Manchester District Institution of Gas Engineers on Nov. 29, 1890.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 45.)

THE past week has been a more interesting and more eventful period on the Stock Exchange than any we have recently had. Incidents pulling in different directions have influenced prices sometimes up and sometimes down. The opening was sinister, affected by the cruel assassination of the French President; but subsequent political action following the tragedy was reassuring. The bright weather helped our home rails, except those specially affected by the Scotch strike. Even Americans shared in the buoyancy, until the Pullman strike depressed them. The adverse influences, coupled with the superabundance of money, worked in favour of the choicest investment securities, many of which have advanced in value. A leading feature of the week was the settlement, which was looked forward to with some little misgiving; but it was apparently accomplished without difficulty. After it was over, business became very quiet; and the Exchange was shut altogether on Saturday. The Money Market received a slight fillip from Stock Exchange requirements; but it was only evanescent. Gas has been very quiet, but extremely firm; all good stocks being scarce, and buyers outnumbering sellers. Several issues have made considerable improvement, and none retrograded. Gaslights were in good demand; and the "A" stock steadily advanced until it topped 240—the 5-per-cent. for money figure. Hardly anything was done in the secured issues; but what little was offered was readily taken at very good prices. South Metropolitans were very buoyant; and all three capital issues advanced. The debenture also ought to have been put up, as it was done at a price above the top quotation. Commercials marked improving prices; but the quotation was left standing. Suburbans and Provincials were quite stagnant. The tendency in Continentals was as favourable as among the rest; and they all changed their quotations for the better. None of the rest made any change, except that Buenos Ayres debentures were erroneously put down 3 on Thursday, and were reinstated the next day, with half a point to the good. Business in Water was fairly active, especially in Lambeths; and further advances in price have taken place.

The daily operations were: Business in Gas was quiet on the opening day; but a disposition to rise was at once manifested. South Metropolitan "A" rose 3; and ditto "B," 1. Chelsea Water gained 3. Transactions on Tuesday were restricted to a small compass; and the only move was an improvement of 1 in Gaslight "A." Wednesday brought no increase of business; but higher prices were still obtained. Gaslight "A" advanced 2½; Imperial Continental, 1; and Union preference, 5. Thursday was the most active day of the week, and again prices moved up freely. Gaslight "A" rose 2; South Metropolitan "B," 1½; ditto "C," 2½; and European part paid, ½. Grand Junction Water was 2 higher. Friday's business was moderate; but good prices were realized, with quotations unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of Woodhouse and Rawson United, Limited—Mr. W. Chew on the Electric Lighting of Blackpool—Proposed Electric Lighting for Adelaide.

THE electrical and financial world has been interested during the past week in the bankruptcy proceedings in connection with the winding-up of Woodhouse and Rawson United, Limited. A public examination of the Directors and officers of this notorious Company has been opened and is still going on; one of the last witnesses to be examined having been Lord Aberdare, a prominent member of the original Board. The statements made by this unfortunate old nobleman constitute an "eye-opener" as to the degree of protection afforded to shareholders in speculative concerns by the presence on the Board of gentlemen of standing and means. Several other Directors, some of whom had retired betimes from a position which they had discovered to be compromising, have also contributed to the instructive history of the Woodhouse and Rawson venture; and when the story is complete, it will form one of those records which people with money to invest ought to keep by them and read over at intervals. It would also form a valuable appendix to a Directors' Guide, containing as it does a pointed warning that the "simple faith" which the poet has declared to be worth a great deal more than "Norman blood," is not a sufficient equipment for gentlemen of high social standing but slight commercial knowledge, who are liable to the temptation to increase their incomes by the fees attaching to directorates of joint-stock companies of a speculative order. It is when one sees what so often comes of yielding to this temptation that one is led to regret, with Mr. Gilbert, those golden days of Good King George, "When noble lords did never itch, To interfere in matters which They did not understand."

One of the most interesting of the papers read at the recent annual meeting of the Incorporated Gas Institute was that by Mr. William Chew, of Blackpool, in which the conditions and circumstances of the gas and electricity supply of this well-known seaside resort are stated and compared. It is something new for an engineer situated as Mr. Chew is to come before a meeting of gas managers and discuss with them, as one of themselves, the *pros* and *cons* of the two systems of lighting. It must be conceded that Mr. Chew acquitted himself on this occasion with a candour and straightforwardness that left nothing to be desired; and useful as his paper is, the remarks and admissions with which the author supplemented it in his reply upon the discussion are almost more valuable. The paper started by putting the chief advantage of electric lighting on the ground of its not vitiating the air of interiors as lights of combustion necessarily do to a certain extent; but this claim was easily disposed of in the course of the discussion, when it was pointed out, with irrefutable cogency, that people need air to breathe, however the place in which they happen to be housed may be lighted. Perhaps the most valuable piece of information extracted from Mr. Chew with respect to incandescent electric lighting was the admission that, to all intents and purposes, a so-called 16-candle lamp does not throughout its life give more than 12 to 14 candles illuminating power to the user; thus placing it about on a par, as regards useful effect, with a flat-flame burner consuming ordinary coal gas. It was made abundantly clear, in the course of the discussion, that gas engineers, as a body, have no sort of objection to, or jealousy of, electric lighting; but that they do complain when municipal electric lighting ventures are nursed into an appearance of prosperity at the expense of the gas department. In connection with this aspect of the two interests, we heartily endorse the declaration of Mr. Alderman Miles, of Bolton, who holds that, if the inhabitants of an important town where the gas undertaking is public property desire the luxury of electric lighting, they should have it provided for them at a charge sufficient to make the undertaking self-supporting.

An energetic city councillor of Adelaide, South Australia, has recently made a tour of the world upon the Pickwickian principle of collecting knowledge for the benefit of his fellow-citizens at his own expense. His insatiable appetite for useful information has been more omnivorous than discriminating; but if he has had a preference for one kind of knowledge over others, it was for data relating to electric lighting. He returned home with a firm conviction that it is the bounden duty of the city of Adelaide to spend at least £50,000 in providing a public supply of electricity for lighting and power purposes; and he is sparing no pains to carry his point. He asserts that, under his scheme, the city will make a profit of exactly £1119 per annum; but it is somewhat curious that, among all the voluminous statistics that were collected by him with respect to municipal electric lighting in England, there is no entry of any similar result as having been actually attained in practice. It is, of course, possible that an electric lighting speculation might succeed in Adelaide; but we seem to have reminiscences of sundry Australasian branches of electrical supply companies with head-quarters in London, and yet do not remember that any of these ever did much business. The price of gas in Adelaide is 6s. 8d. per 1000 cubic feet to private consumers, with a reduction upon the public lighting; and this charge is not far from equality with electricity at 8d. per unit. The City Council are assured, however, by their amateur advisers, that they could supply electricity at a good profit for 6d. per unit. As to this it may be remarked that there are very few electrical supply undertakings in the United Kingdom which can keep open their doors at any such figure, even where gas is selling for from 2s. to 2s. 6d. per 1000 cubic feet. It is most likely, moreover, that the conditions which govern the cost and price of gas in a colonial capital and make it so much dearer than the same commodity at home, would affect in the same way the cost of generating electricity; so that, after they had put down their works, the Electric Lighting Committee of the Municipality of Adelaide would find themselves compelled to charge something like 1s. per unit, or even more. Curiously enough, the fortunes of electrical supply undertakings do not seem to be greatly influenced by the cost of gas in the same locality, nor by climatic or other considerations of this nature. The truth is that electric lighting is a luxury; and as such it will be adopted by the luxurious everywhere; so that the one governing factor in all computations of the prospects of commercial electric lighting is not the cost at which it can be produced, but the number and situation of the wealthy people who are disposed to patronize it.

The Gas, Water, and Electric Lighting Companies' Directory for 1894.—We have received from the publishers (Messrs. Hazell, Watson, and Viney, Limited) a copy of the above directory for the current year. It is the 18th edition of the work; and the contents have been revised and the statistics brought up to March 31 last. The latter are preceded by a summary of the leading events in the three industries in the twelve months immediately preceding the date of publication; and a list is given of the Associations of engineers and managers of gas, water, and electric lighting undertakings in all parts of the world. It is, of course, impossible to ascertain, except by use, how far the labours of the compilers have been successful in ensuring accuracy; but the Editor must be credited with making every effort to render his work serviceable to those for whom it is intended.

THE FINAL REPORT OF THE LABOUR COMMISSION.

In essaying the task of acquainting our readers with the nature of the contents of the Fifth and Final Report of the Royal Commission on Labour, we are confronted at the outset with a sufficiently formidable difficulty in regard to selection. Everybody knows how the Commission was constituted; and what was done by way of collecting evidence as to the conditions of labour generally and in connection with particular industries—including that of gas manufacture—is already upon record. The Commission did a very great deal more than this, however; and the first portion of the report is devoted to a particular statement of the character and objects of every department of the work of the Commission and staff, with an indication of where the results of every kind are to be found. It has become a habit of some technical journals and others to refer slightingly to the work of the Commission, mainly because the evidence taken by the different groups, and by the whole body, seemed to be collected in a hap-hazard way, and was not tested by formal cross-examination, and because the reports that have appeared from time to time, including the last, have not proposed to turn the industrial world upside down. It seems, however, to an impartial critic of both the Commission and its detractors, that it would be unfair to appraise the work of the Commissioners and their very able staff by its most obvious and immediate fruit. As the Commissioners say for themselves: "The range of our inquiry has been very wide. The work undertaken and carried on during the last three years has been of a magnitude and extent unprecedented in the history of Royal Commissions; and we desire to record our opinion that its results are of the highest value, and cannot be measured solely by the contents of our report itself." At any rate, the Commission has been the means of enabling everybody who had anything to say respecting labour questions, to say it; and the printed records of the inquiry form a whole library of, in the main, fresh and valuable information.

In generally reviewing the evidence laid before the Commission, the report summarizes a great variety of interesting statements. It is remarked among other things that the general impression left by the information collected with respect to wages, is that the level of wages-rates has risen considerably during the last fifty years, both in respect of their nominal value and (with the exception of house-rent in large towns) their power of purchasing commodities. This latter consideration, be it observed, constitutes the wage-earner's "unearned increment." Where the subject-matter is a cause of variance between employers and employed, as (for example) the question of piecework or of apprenticeship, the report usually gives the gist of the views of both parties, without pronouncing judgment upon them. Upon the natural and fundamental distinction between skilled and unskilled labour, the report makes some incisive observations, tending to show how the difference between the old and the new Trade Unionism springs out of the different character of the occupations of the men so organized. It is remarked that the fact that a trade is skilled—*i.e.*, requires prolonged and special training in those who practise it—constitutes it a kind of natural crafts guild, defended from sudden invasion by men of other trades. Consequently, when a skilled industry is carried on upon a sufficiently large scale it is easy to convert the natural craft into a formal and permanent trade union. On the other hand, unskilled or general labour stands upon a different footing. "The evidence shows that trade societies among the class of unskilled labourers have been apt to rise suddenly and rapidly, enrol a great number of members, and then as quickly decline. . . . Upon the whole, it is not as yet shown by experience that it is easy, if, indeed, it is practicable, to mould into a permanent organization men working at an occupation which is not of the nature of a craft requiring special training." And it is further recognized that it is the absence of that natural monopoly which the skilled tradesman enjoys, that conduces to the more violent action of the new trade unions in the conduct of industrial disputes.

The arguments for and against trade unions of both kinds are clearly and succinctly set out in the report. It is stated that the employers who gave evidence before the Commission usually recognized a legitimate province for trade unions in bargaining as to wages and hours, and watching over the general interest of their members; and they admitted that strong organizations, acting within those limits, tend on the whole to improve industrial relations, and to make their members act in a better informed way and in a more reasonable spirit. But a strong indictment has been drawn up against the actual working of the unions, even out of the mouths of those employers who hold these general opinions. It is alleged that trade unions have a growing tendency to interfere with details of business and usurp the functions of managers; that trade unions often misjudge the position of affairs, and by ill-timed and excessive demands, as well as by placing employers under apprehension of these, discourage enterprise and further investment of capital in this country, to the detriment of all concerned; that, though organizations may tend to diminish the frequency of industrial conflicts, they extend their range; that workmen with a powerful union behind them are apt to become spoilt; that the action of trade unions has a tendency to bring about a uniformity of wages and hours, both as between individual workmen and as between different localities; and that, by insisting on a minimum wage which in effect determines the standard, and by seeking to abolish overtime and piecework, they are reducing workmen to a dead level of enterprise, discouraging work of more than average merit, and taking away from individual workmen the motive power of ambition and self-interest; lastly, that the unions injure trade by the rigidity of their rules.

These assertions are, of course, traversed by the representatives of the trade unions; and the report allows accusations and denials to speak for themselves. The Commissioners declare, moreover that they have not lost sight of the fact that the concern of the community, as a whole, with regard to the strength of organization of employers and employed, and the agreement between them which it may be possible to obtain, is not limited to the effect of such strength or agreement upon the interests of these classes. For instance, it is pointed out that agreement between a strong combination of employers on the one side, and workmen on the other, may possibly be attained in some cases by measures which tend to repress individual energy and freedom of industrial experiment. "One result of such agreement may be to place difficulties in the way of new men endeavouring to work their way into a trade by means of methods of production not sanctioned by the existing trade custom. Such changes, though not immediately convenient to the employers and employed already engaged in a trade, have often, in the end, by enhancing the efficiency of production, conferred important benefits upon the public, and have contributed to the ultimate prosperity of the trade itself." In effect, there is a risk of the creation of monopolies in the interests of employers and employed, and to the detriment of the community.

Having thus foreshadowed the possibilities of an imaginary complete organization of industry, the report goes on to discuss the existing incomplete arrangements of the kind, and to summarize the present state of the relationship of employers and employed. This part of the inquiry is considered under two heads, covering respectively those cases in which the relations are between employers, or bodies of employers, and strongly organized bodies of workmen, and cases where the workmen's organizations are weak or non-existent. With regard to the former class, the evidence received by the Commission points to the conclusion that, on the whole, and notwithstanding occasional conflicts on a very large scale, the increased strength of organizations may tend towards the maintenance of harmonious relations between employers and employed. Various qualifying considerations are admitted by way of set-off against this view; but the most serious objection to this condition of industrial affairs—the undue power that it places in the hands of self-seeking trade union officials—is passed over without mention by the Commissioners. There can be no disputing the observation of the report that the most quarrelsome period of a trade's existence is when it is just emerging from the patriarchal condition in which the employer is also the master, and has not yet learnt by experience how much mastery must needs remain to the employer after the workmen have organized themselves. The new unions are presumptuous in proportion to their callowness. Their leaders insist upon being "recognized;" and, as in the case of the gas workers, these wire-pullers of a day are too fond of talking about the "demands" of labour in a tone calculated to incense employers.

The report deals in temperate language with the vexed question of trade union *versus* free labour. It is observed that the supply of free labour practically governs the organizations of the unskilled trades, and it is in connection with the attempts of the unions established for the organization of such "trades" that the issue of the government and control of industrial undertakings has been raised. "Employers have felt it to be essential to resist to the utmost of their power the claim made by workmen in the unskilled trades to prevent them from employing non-unionist labour." And it is admitted that "the claim also of non-unionists to dispose freely of their labour is one that cannot be left out of account in this connection." Next comes the question of the relations of employers and employed, altogether apart from the action of trade unions. There were those who told the Commissioners that the unions took all the credit for improvements in the condition of workmen which would have come about without them; and the Commissioners appear to think that, in cases where the same men are regularly engaged, there is not much ill-feeling between employers and employed, "although there may be often a good deal of grumbling on either side." The report goes at considerable length into the different methods actually in use for the apportionment of the workmen's share in the products of industry; and the operation of sliding scales and wages boards is explained.

This leads up to the subject of profit-sharing; and we could not find better matter to conclude this first instalment of our notice of the report than this most important section of it. The Commissioners admit that many of the witnesses who appeared before them expressed dissatisfaction with the present system by which industries are organized. Various devices for harmonizing, as far as may be, the interests of employers and employed in private undertakings were suggested, among which the simplest is profit-sharing; and it is important to notice

that the report states that, "in all cases where profit-sharing has worked well, the evidence shows that the system has been highly conducive to the maintenance and increase of friendly feelings between employers and workmen." Special reference is made to the arrangement in force at the South Metropolitan Gas-Works, which is stated "to have improved greatly the relations between the Company and its workmen, to have caused the latter to take greater interest in the success and economic efficiency of the business, and to have given them opportunities, of which they have largely availed themselves, of accumulating savings by investment with the Company of the bonus which they receive under the scheme." Mr. Livesey's "Memorandum" describing the system forms the first appendix to the report. The consideration of profit-sharing leads naturally to that of co-operative production, in which the aim is to eliminate the individual capitalist employer. The Commissioners entertain no illusions in these regards, however. They perceive that, while it is to be hoped that the principles of profit-sharing and co-operation will become more widely extended (at all events in certain classes of business), yet at present the establishments in which they have been adopted bear a very small proportion to the bulk of manufacturing industry.

NOTES.

Steam Superheaters.

The advantages of superheating steam for many purposes, and especially for making water gas and fuel gas, have long been an inducement to engineers to attempt to devise suitable apparatus for effecting this purpose. An appliance of the kind has been adopted by Messrs. Bryan Donkin and Co., and is known as Gehre's patent steam superheater, for which an economy of 20 to 25 per cent. is claimed. Mr. E. Schwoerer has also devised a pattern of steam superheater, which Professor Unwin has found to yield an economy of 18½ per cent. Recently a superheating apparatus has been introduced by Messrs. M'Phail and Simpsons, of Wakefield, which has been exhaustively tested by Mr. J. F. L. Crosland, Chief Engineer to the Boiler Insurance and Steam Power Company, of Manchester. It consists of a series of steel tubes placed in the boiler-flues; but it has the distinction from other arrangements of the kind that the steam, after passing through the superheated pipes, is led again in a tube through the boiler below the water-line, once more superheated, and a second time passed through the boiler before being delivered into the main steam-pipe. By this course, a great amount of the superheat taken up by the steam is transferred to the water in the boiler; and what remains cannot hurt the engine. As applied to a Lancashire boiler, Mr. Crosland found that the M'Phail and Simpsons arrangement increased the proportion of heat utilized by the boiler from an average of 55·6 per cent. to 76·27 per cent.; showing a gain of about 37 per cent. from its use.

The Colour of the Electric Arc Light.

Professor J. A. Fleming has shown that the well-known colour of the light of the electric arc from carbon points is due to the incandescence of the carbon filling the space between the positive and the negative rods. The true arc is here, and exists in a space filled with the vapour of carbon, which has a brilliant violet colour. Examined by the spectroscope, the central axis of the carbon arc gives a spectrum marked by two bright violet bands. Outside this is an aureole of carbon vapour of yellow or golden colour. The electrical strain of the arc occurs chiefly at the surface of the crater which forms at the end of the positive rod, where, in fact, the principal work of generating light is done; for 80 per cent. of the total light of the arc comes from the incandescent carbon at this place. Thus, in a sense, the arc light is mainly an incandescent light; the effect being produced by the layer of carbon which is being constantly evaporated at an extremely elevated temperature. Hence the light of the carbon arc is not, and can never be, white, as it is sometimes described as being, but must always be tinted violet by the carbon vapour normally present between the rods.

The Care of Machine Belts.

In a paper on the subject of machine belting contributed by Mr. F. W. Taylor to the Transactions of the American Society of Mechanical Engineers, the author points out that the chief consideration that has governed the compilers of the accepted rules on belting has been that of getting the maximum of work from belts, whereas the one consideration that should have more weight than all others in making up rules and tables for belting practice is that of securing the least possible interruption to manufacturing operations from this source. It is Mr. Taylor's judgment that belts should be made heavier and run more slowly than the accepted rules would indicate, and this not only for the sake of reducing the belt bill in the long run, but even more to avoid frequent interruptions to manufacture. By far the largest item in the total of the cost of belting is the time lost in relacing and repairing them. Mr. Taylor instituted a nine years' experiment upon the belting of a machine-shop under his control, in the course of which he introduced many reforms in the treatment of the belts. All his belts were made endless by splicing, gluing, and pegging, instead of lacing or hooking; and double belts were used throughout. The countershafts were mounted upon independent frames, which allowed of tightening the belts by raising the shafting by the introduction of packing-pieces. With this method of tightening, it was seldom necessary to resplice a belt, since 6 to 10 inches of stretch could be taken up by gradually raising the countershaft, before splicing became necessary. At intervals of three months, every belt was scraped clean and dubbed; and an accurate account was kept of the cost of every belt, and of all repairs to it during its lifetime.

An Effect of a Miners' Strike.

An instructive illustration of the manner in which trade is sometimes permanently diverted from one course into another by a temporary labour trouble is furnished by an incident in the life of the late Mr. Joseph Tomlinson, when he was Locomotive Superintendent of the Taff Vale Railway. It had been customary to burn a particular description of coking coal from the Rhondda Valley in the furnaces of the locomotives of the Taff Vale Company, because it was thought to be practically impossible to make use of Welsh steam coal for the purpose, owing to the great rapidity with which the fire-bars were burnt out. It was considered that this mischief was due to the formation of clinker on the bars. So long as the Rhondda Valley coal was obtainable, it continued to be used by the Taff Vale Company; but there came a strike of the coal miners in the valley, and it was consequently a question of finding a substitute for the customary coal supply or of stopping the traffic. In this emergency, Mr. Tomlinson found that the burning out of the fire-bars with Welsh steam coal was easily preventible by covering the latter with a layer of small pieces of fire-brick—a device which had the effect of giving the bars an average life of four months when running 100 miles per day. It is stated that so successful was Mr. Tomlinson in remedying the defect in question, that thenceforward the Rhondda Collieries lost the Taff Vale Company's custom. The same kind of cause and effect has been experienced in connection with other industrial disturbances; but this example is peculiarly clear and instructive.

The Spontaneous Ignition of Lamp-Shades.

Dr. A. Dupré has described, in a letter to *The Times*, a remarkable instance of the spontaneous combustion of a paper lamp-shade. It is stated that the shade in question was made about a year ago in the familiar style, of two sheets of crinkled tissue paper—one white and one yellow—gathered together at the top, and fixed to the wire frame; forming a considerable bunch of the material. For two days prior to the accident, the lamp had not been lighted; and there had been no fire in the room. After the morning of the day of the fire, when the room was dusted and the shade seen to be apparently in its usual condition, the apartment had not been entered; and when the charred remains of the shade were at length found, the indications were such as to leave no doubt in Dr. Dupré's mind that the case was one of genuine spontaneous ignition. The cause is ascribed to the presence of chromate of lead in the yellow paper. The dangerous quality of such papers is readily detected by setting fire to it, and blowing out the flame. In the case of an ordinary paper, it will be found that the glow along the burnt edge is very soon extinguished, while the presence of chromate of lead in paper causes it to act like touch-paper. Besides the yellow paper, pale green tissue papers are also coloured with the chromate, and would doubtless be equally dangerous; and there may be others in the same condition. The extensive use of the prettily-coloured crinkled papers for home-made lamp-shades, &c., lends importance to Dr. Dupré's discovery. He admits that he has not yet been able to reproduce experimentally the necessary conditions leading to the spontaneous ignition described; but possibly the long drying that a year-old lamp-shade receives had something to do with it.

Incorporated Association of Municipal and County Engineers.—The annual meeting of this Association was held in the lecture-room of the Institution of Civil Engineers on the 21st ult. The report of the Council, which was read by the Secretary (Mr. T. Cole), showed that 71 new members had joined the Association during the past year—being 58 ordinary members and 13 graduates; bringing up the total to 599, composed of 9 honorary and 537 ordinary members, and 53 graduates. The Council congratulated the members on the continued success of the Association, and reported that Mr. A. M. Fowler, of Manchester, had been elected President, and Messrs. Binnie, Escott, and Lowe, Vice-Presidents for the current twelve months. The premiums for the best papers read during the year had been awarded as follows: The first (£10), to Mr. G. Hodson, of Loughborough, for his paper on "The Consideration of Some Conditions Affecting Underground Water Supply;" the second (£5), to Mr. J. S. Pickering, of Nuneaton, for his paper on "Sewage Difficulties at Nuneaton and their Solution." The premiums having been presented by the retiring President (Mr. J. T. Eayrs, of West Bromwich), he introduced his successor in the chair, who, after the customary votes of thanks had been accorded, proceeded to deliver his Inaugural Address, to some portions of which we may have occasion to refer in a subsequent issue. The annual dinner took place in the evening, at the Holborn Restaurant.

COMMUNICATED ARTICLES.

AN IMPROVED TAR-EXTRACTOR.

By F. D. Marshall, Engineer of the Danish Gas Company.

For some reason or another, tar-extractors do not appear to have been very popular in English gas-works. I am at a loss to account for this, as in French, German, and Continental works they are regarded as a very necessary adjunct to properly designed plant; and my own experience of them is so favourable that we adopt them whenever an opportunity occurs. The commonly-accepted notion of an extractor is, I am afraid, anything that baffles the progress of the gas; and many descriptions of patented apparatus, in the form of plugs to be inserted into the condenser-pipes, &c., have appeared. But I am not aware that they have commanded any degree of success. One point must be clearly borne in mind, and that is that the position of the extractor as regards the condensers is of vital importance to its successful working. The temperature of the gas must also be closely attended to. In a properly-constructed extractor, it is not necessary to lower the temperature beyond a temperate degree.

The tar-extractor of Messrs. Pelouze and Audouin is a good apparatus, and is very popular in France. Two of them that

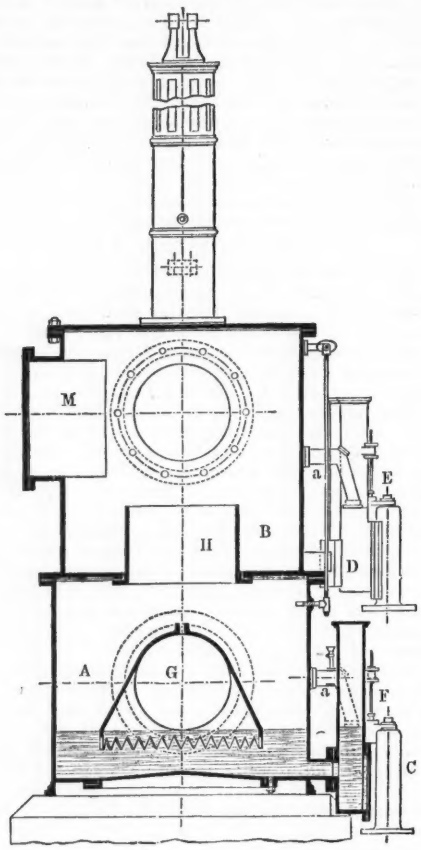

FIG. 1.

I have at work in different towns give satisfaction; and by their use we are able to avoid excessive condensation, or an unnecessary lowering of the temperature of the gas during the severe winters to which we are occasionally subjected. The details of construction of the Pelouze and Audouin extractor are well known to gas engineers. Suffice it to say that the appliance is what may be termed a *dry* extractor, and is not combined with any washing arrangement. Some years ago, Herr Drory, of the Imperial Continental Gas Association, invented another form of extractor combined with a washer. This apparatus met with much success, and is in use in a great number of German works. There were, however, one or two drawbacks in the arrangement; and the object of this article is to lay before the readers of the JOURNAL a new and improved form of this extractor.*

The new form of extractor combines a perfect tar-extractor with an excellent washer, and consists principally of the washer A and tar-extractor B, fig. 1. In the washing chamber A, the gas passes through ammoniacal liquor from under the bell with serrated edges. There is nothing particularly new in this form of bell; and it is adopted because it is effective as a washer, and no stoppages are liable to occur. The action of the washer, in addition to removing a large percentage of ammonia, which it does thoroughly, is to split up the tar into globules; and these, carried forward by the gas after passing the washing chamber, are completely removed by the upper chamber or extractor. Both the upper tar chamber and the lower washing chamber are supplied with a limited, but continuous, stream of weak ammoniacal liquor. Each of the chambers is furnished with a specially designed overflow arrangement, whereby the tar and ammoniacal liquor are completely separated; and only liquor is allowed to remain in the chambers. The variation in the chambers A B and in the overflow-boxes is adjusted by a pipe *a*; and the height of the necessary seals, by valves E F.

The bell to which the tar-extractor plates are attached—and the arrangement and construction of these plates is the vital and improved portion of the apparatus—is suspended and regulated by a counterbalance, so that the necessary resistance to the passage of the gas (preferably about 2½ inches) can be regularly maintained. The pressure in the washing chamber is regulated to a resistance of about ¼ inch.

The apparatus works best when the temperature of the incoming gas is maintained as nearly as possible at 59° Fahr.; and the supply of ammoniacal liquor should preferably be maintained about this temperature. As before pointed out, the temperature of the gas entering the extractor is of the greatest importance.

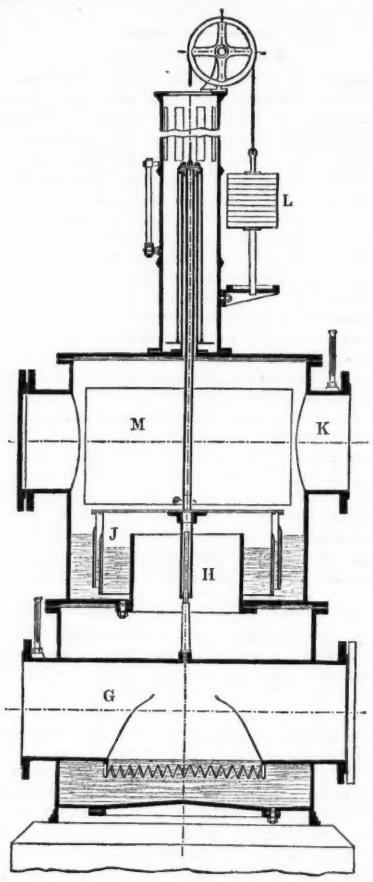

FIG. 2.

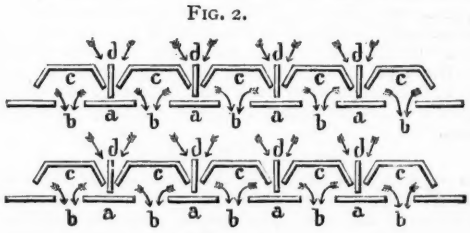

FIG. 3.

The extractor plates in the bell J are arranged concentrically in a double ring (see fig. 2). The interior plates of each ring are slotted; whereas the openings in the exterior plates are rather larger, and are funnel-shaped (fig 3). Between these openings, formed by plates *c c c*, are introduced long thin plates *d d d*, dividing the opening, and causing the gas to impinge on plates *a a a* before passing out through the slotted openings *b b b*. Owing to the action of the washing chamber, the suspended bell is continually in motion; and this vertical vibratory action of the bell subjects the plates *c c c* to a continual rinsing process, and consequently no tar adheres to them.

We have an apparatus of this description designed to pass

* The appliance referred to was described and illustrated in our "Register of Patents" on the 5th ult.—ED. J.G.L.

750,000 cubic feet of gas daily at the Frederiksberg works of the Danish Gas Company; and, after being in use many months, the plates proved on examination to be as clean as on the day the apparatus was started. Experiments made with a similar description of apparatus showed that 99 per cent. of the tar entering the apparatus, and from 14½ to 21 per cent. of the ammonia entering it, were completely removed. Should the plates, by any chance, become choked, they can easily be removed, without removing the bell, and a new plate facet substituted.

GAS COMPANIES AND IRONMONGERS—THE GAS-STOVE QUESTION.

By a Gas-Works Manager.

The *Ironmonger* is directing attention to the alleged rights of the ironmongering trade in the matter of gas-stoves. It has addressed a circular letter to managers of gas-works, enclosing therewith a reprint from its issue of May 26, which comprises an editorial pronouncement on the subject, a letter from Messrs. Hersey Bros., Limited, a "round robin" signed by some thirty firms, among which appear certain well-known names, to the effect that "the position of affairs with regard to the competition by gas companies warrants a meeting of the trade being called to discuss what steps should be taken to obtain redress," and a letter from a Mr. Charles Provis, of Emsworth, in which the action of a particular Gas Company in issuing a circular offering to supply gas-stoves at cost price, is condemned in no measured terms. The following is the circular letter:—

> Gentlemen,—It is suggested that it might relieve many gas companies from the trouble and possible losses of their stove selling and hiring departments if a better understanding could be arrived at between themselves and the local ironmongers on the subject. In addition, it is believed that such understanding would result in a considerable increase of the day sale of gas, inasmuch as the ironmongers would have every inducement, if a fair basis can be arranged, to display and push the sales of gas warming and cooking appliances.
>
> Having the impression that gas companies and the gas departments of corporations would be pleased rather than the contrary to be relieved of the worry—and often losses—incidental to hiring, I take the liberty of thus addressing you on the subject, in the hope that you will favour me with a reply giving your views, with any suggestions as to the best manner of enabling ironmongers to promote the sale of gas-stoves.
>
> Your reply would not pledge you to any particular course of action; but it would assist me in gathering a consensus of what I may term "gas opinion," which should be of real service to the companies generally, as well as to the trade on behalf of which I write.
>
> I hand you, herewith, a reprint of an article from the last issue of the *Ironmonger*, and solicit your full and frank reply.

The editorial article is not likely to enlist the sympathies of gas companies. Among other curious statements, it alleges that "it is a fact beyond the reach of controversy that the trade have allowed gas companies to take far too decided a lead in the sale and hire of gas-stoves. . . . . Most of them have a sale and hire department, and most of them would be very pleased to get rid of the nuisance and losses involved in the hiring section. . . . . It is pretty obvious that the situation is particularly favourable for a decided forward movement on the part of ironmongers. . . . If ironmongers as a body would undertake to go into the gas-stove branch fully and adequately, the gas companies would be disposed to make an arrangement which would be fair to all parties concerned, and which would probably give a marked impetus to the sale of gas heating and cooking appliances." After giving reasons for a full discussion in the correspondence columns, the writer recommends the collection of information from the published reports of gas companies; and he adds, as encouragement, that, "mainly through the efforts of one ironmonger, a very influential provincial gas undertaking totally relinquished its stove department." The gist of Messrs. Hersey's letter is the suggestion of an amicable arrangement based upon the following alternatives: (1) The companies to cease selling or hiring altogether. (2) The companies to cease selling, but to continue hiring at rates which would equalize competition with selling. (3) The companies to continue selling and hiring—the former at retail list prices, the latter at the altered scale of rates suggested. If amicable attempts at compromise prove abortive, the writers would resort to some "invincible conjunction of forces" that has already proved useful in protecting the rights of ironmongers.

It may be at once conceded that gas companies, in entering upon the stove and fitting trade, have not been actuated by the wish of directly making extra or additional profits beyond those secured by the sale of gas; and, further, that the hiring department, as a separate and distinct venture, is not really a lucrative one. But our friends of the *Ironmonger* are somewhat mistaken in the view that it is attended with so much loss that its surrender would be a small or trifling matter. In most cases, the gas companies have had the question forced upon their attention, and been obliged to take it up in self-defence. Consumers complained that they could not get their requirements fully met. Many tradesmen knew little, if any, more about the proper way of using gas than could be gathered from the trade catalogue. The workmen sent to fix the appliance did not consider the quantity of gas required, the proper size of supply-pipe, &c. When complaint was made, the tradesman did not care to take the trouble to go to the root of the matter, or possibly was not competent to do so; and in this way the apparatus was rejected as useless, or perhaps the gas offices were resorted to as a final appeal. Many gas companies were drawn into the fitting business gradually, by reason of such complaints. After the gas manager had remedied a difficulty, it was perfectly natural that the customer should turn to him the next time he wanted additional gas-fittings, rather than to the ironmonger, and equally natural that he should blame the company as "unenterprising," if they refused to carry out his requirements. Gas companies further found that many ironmongers were also vendors of oil and petroleum, and therefore preferred to keep a better and more modern stock of oil-lamps than of gas appliances, and, with an eye to the supply of oil, recommended the former rather than the latter. Then in the matter of selling at cost price, or hiring at low rates, the only question was that of expediency. In the majority of cases, gas-fitting and hiring is a recent acquisition that would never have been resorted to if ironmongers had gone into the gas-stove trade fully and adequately. There had already been an opportunity for the trade to show what it could do; and the greater part of the apparatus sold below usual retail rates, or hired on similar terms, would never have been placed at all in the ordinary way of trade. So it cannot justly be claimed that the local ironmonger is injured to the extent of losing a trade profit by every appliance disposed of in that way.

Bearing these facts in mind, and also the increasing competition from cheap oils for which our friends are largely responsible—it is difficult to see where the *quid pro quo* for following the example of the "very influential provincial gas undertaking" is likely to come from, and especially how ironmongers are going to give a "marked impetus to the sale of gas appliances." They certainly did not do so when they had a free field before; and several towns yet remain where the only obstacle in their way is the letting of stoves on hire. Gas companies will never admit that there is any question of principle in the matter, and that they are exceeding their just rights in selling or hiring below the usual trade terms. The only way is for the *Ironmonger* to show them that it is to their advantage to relinquish the fitting and hiring department.

Given a free choice, there is no question between buying and hiring. Gas companies would much rather the consumer was the owner of the whole of his appliances; and they only resorted to hiring as a means of securing a large class of custom that was otherwise unattainable. They found that many who, for various reasons, would not buy, would hire, and the *Ironmonger* will scarcely contend that the fear of interfering with certain trade profits should deter them from developing this opening for the sale of gas. It was the desire to sell rather than to hire that led to the offering of special terms or reductions from the usual retail rates to which our friends so strongly object. It is difficult to see how this line of business could be met by the ordinary retail trader, because it is an essential of the hiring business that the rent charged should be comparatively trifling. Gas companies would not object to hire at double or treble the ordinary rates; but the consumers would simply refuse to pay them. The low hiring rate, or the cheap selling price, is regarded by the consumer as a concession that he may reasonably claim from the gas company; and it will be difficult to convince him that the company have no right to sell at less than list prices, or to hire at rates lower than those which might be acceptable to the "trade."

Again, assuming that an arrangement between gas companies and "the trade" had been arrived at, there are the various co-operative societies and firms doing business on co-operative principles to be reckoned with. Many of these supply goods at a margin of about 5 per cent. on the actual cost. Even the list of firms above mentioned includes at least one with the words "for margin of 10 per cent." added. It will thus be seen that our friends are not unanimous as to what constitutes a fair scale of prices.

A Gauge for Recording High Pressures.—At the recent meeting of the American Society of Mechanical Engineers held in Montreal, Professor W. H. Bristol, of the Stevens Institute, read a paper in which he described a new gauge for recording extremely high ranges of pressure. It is intended to withstand working pressures of 1000 lbs. or more. The spring part of the gauge consists of a Bourdon tube of flattened cross-section, wound into a small helical form of four complete revolutions. One end of the tube is rigidly fastened to a bracket, with an opening for the pipe leading to the gauge. On the end of the spring, free to move by the application of pressure, a pen arm is directly secured. The pen records on a chart moved by clockwork. As the diameter of the helical coil is small, and any movement of the free end is distributed through the four complete turns of the tube, the angular movement necessary to carry the pen arm over the chart will not be great enough to cause a permanent set in the tube. In the discussion which followed the paper, one speaker expressed the opinion that a very important point in favour of the new gauge was that the tube contained more metal than that of the Bourdon gauge, and that consequently there would be less liability to its being influenced by any molecular change, or to its taking a permanent set.

TECHNICAL RECORD.

THE LIGHTING OF THE TOWER BRIDGE.

The important undertaking—the Tower Bridge—which was brought to a successful completion last Saturday, and formally inaugurated by His Royal Highness the Prince of Wales, on behalf of Her Majesty, will possess special interest for many of our readers, from the fact that, by the courtesy of the Contractors—Sir William Arrol and Co., Limited—they have had opportunities afforded them of inspecting the works during their progress. The particulars furnished on those occasions in regard to the structure generally may be usefully supplemented by the following details as to the lighting.

The bridge and its approaches are lighted entirely by gas, with brilliant effect; upwards of 200 of Sugg's high-power gas-lamps being used for the purpose. The various arrangements made for the illumination by night of this huge water-gate of London constitute a most important installation of public lighting. The excellence of the lighting is such that it is possible to read a copy of *The Times* by night on any part of the bridge. On the North Approach (City side), there are about 40 large hexagonal gas-lamps, all fixed upon handsome cast-iron standards mounted on the parapets. The shore spans and South Approach are lighted by similar lamps elevated upon ornamental cast-iron columns erected at the edge of the kerb. The lighting of the opening span is provided for by means of four lamps of special construction each having an effective illuminating power of 400 candles. These are suspended from massive iron brackets of handsome design, fixed on the navigation sides of the North and South Towers. It may be mentioned that all the columns and brackets for the lamps have been cast to the special designs of Mr. G. D. Stevenson, A.R.I.B.A. The result is that the lighting arrangements serve an additional purpose which is too often lost sight of, by helping to beautify the structure upon which they are placed. The engine and boiler rooms, machinery chambers on the piers, bascules, accumulator chambers, staircases, lifts, and high-level footways are all lighted in a very effective manner; and in many cases the lamps have been specially constructed to suit the positions they now occupy.

On both sides of the bridge, large gas-meters are fixed; and the mains are so arranged that, in the event of its being necessary at any time to stop the supply on either side, the gas for that side may be obtained from the other. Some eighteen months ago, just after the gas work was commenced, temporary supplies were laid on over the bridge, towers, &c., and lights fixed to facilitate the work of building and to prevent accidents as far as possible. It is not uninteresting to know that these temporary supplies have been gradually removed as the permanent mains were run, without once stopping the supply of gas to any part where light was required.

The whole of the gas work has been carried out by Messrs. W. Sugg and Co., Limited, who have also provided the water-mains and supplies throughout, and the hydrants, tanks, and hand-pumps in connection therewith. The work has been personally superintended by Mr. William Sugg.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Annual Congress at Nimes.

The Twenty-first Annual Congress of this Society was held at Nîmes (Gard) on May 16 and 17, under the presidency of M. PAUL MALLET. The following abstract report of the proceedings is translated from recent issues of the *Journal des Usines à Gaz*, the official organ of the Society.

The members assembled to the number of about 80 on the morning of the opening day. The first business was the adoption of the report of the previous meeting, as printed in the Transactions; and then came the election of new members. As customary, the President of the Incorporated Gas Institute for 1894-5 was at the head of the list; being followed by the names of 18 gentlemen and one lady (Madame Jeanmaire), who sought admission as members, and of 5 gentlemen as associates. These were all unanimously elected. The report of the Committee on the progress of the Society was next presented by the President. It consisted mainly of notices of the members who had died during the year, and of others whose decease had not previously been made known to the Society. The total number of members is unchanged; being 604, composed of 16 honorary and 493 ordinary members, and 95 associates. The contributions made to the funds of the Society by gas companies amounted to 22,480 frs. (£899). The Treasurer (Mons. Deleury) next submitted his report. It showed that at the close of the past year the capital had risen to 147,794 frs. (£5912); being an increase of 11,686 frs. (£467) during the twelve months. The next business was the appointment of five members of the Committee to replace those retiring—viz., MM. Frère, de Vigne, Séguin, Delahaye, and Lenoir—who were eligible for re-election. These gentlemen were restored to their positions on the Committee for three years. This completed the general business at the morning sitting. The Committee afterwards held a meeting for the election of officers for the ensuing year. The following was the result: *President*, M. de Lachomette; *Vice-President*, M. Delahaye; *Secretaries*, MM. Visinet and Frère; *Treasurer*, M. Deleury.

The remainder of the general business consisted of the presentation of reports on the papers submitted in competition, on the premiums awarded for papers read last year, and on the donations to meritorious workmen. There were three memoirs sent in; but two of them were withdrawn. The remaining one, which was on the subject of the production of incandescent lighting by means of gas, the Committee did not consider to be worthy of the Society's prize, inasmuch as the author did not bring forward anything very new, or give the results of experiments conducted by himself personally. They, however, suggested that he should submit his work in the form of an ordinary communication. Out of the 24 papers presented last year, five were by members of the Committee; and consequently they were excluded from the competition. Four of the remaining 19—those by MM. Aguitton, Chauveau, Godinet, and Jouanne—were each awarded a prize of 250 frs. A translation of the important paper by the first-named gentleman, in which he considered the relation of the illuminating power of coal gas to its heat of combustion, was given in the JOURNAL for Aug. 29 last (p. 402); and those by MM. Godinet and Jouanne were briefly noticed in our abstract reports of the proceedings at the meeting. M. Chauveau's communication dealt with the extended use of gas-engines. There were 47 workmen candidates for the Society's prizes of 200 frs. for long and meritorious service in gas-works; and the Committee made 20 awards. The ages of the selected candidates ranged from 49 to 77 years; and the periods of service from 26 to 46 years.

Only a few papers were read at the meeting. MM. Chamon and Maldant dealt with the subject of prepayment meters; M. Maldant also referred to the improvements he has effected in gas-meters to ensure unvarying registration; M. Bengel described an improved kitchener, and M. Weill-Goetz a gas fireplace on the recuperative principle; M. Hovine furnished particulars as to an installation of inclined retorts; M. Stucker presented a note on a regenerative furnace on M. Magot's system; M. Gaston Gautier gave some particulars in regard to an explosion of gas in the neighbourhood of electric light mains in a street at Nantes; M. Ph. Delahaye made a few remarks on some electric light installations in the large towns of England and Germany; M. Frère introduced the Delmas recuperative lamp and reflector; and M. Chevalet described a new arrangement of purifier. There was also an interesting discourse by M. Crova on "Photometry."

The business of the meeting was relieved by two banquets—one given by the Continental Union Gas Company, the other the usual subscription banquet—as well as by some pleasant excursions, and a trip down the Rhône.

MEETING OF ITALIAN GAS MANAGERS.

The Annual Meeting of Italian Gas Managers was held in Turin, from the 18th to the 21st ult. The President was M. Favier, of Palermo; the Vice-Presidents being Baron Lucifero and M. Tina, both of Turin. The meeting was unusually well attended; among those present being representatives of the Continental Union, Anglo-Romano, and Tuscan Gas Companies, and the Cagliari Gas and Water Company. These meetings are perfectly informal, and the discussions quite *a la buona*. The social part of the programme occupies the greatest portion of the time. All the same, the meetings are very useful. The managers from the different parts of the country meet each other, make acquaintances, and exchange ideas and experiences. Considering that many of them are foreigners, and perhaps not sufficiently well acquainted with the Italian language to be able to make a speech or deliver a lecture, the meetings would certainly not be anything like so well attended if they were conducted on the lines adopted in England. The following subjects came up for discussion: Inclined retorts; gas-meters and "penny-in-the-slot" meters; the new Act on Weights and Measures, so far as it affects gas-meters; the taxation of gas-works; gas-burners; gas-engines as substitutes for horses on tramways; and the proposed tax on gas-works. With regard to gas-meters, the necessity for gas suppliers being in a position to prohibit the use of meters out of proportion to the consumption of gas was dwelt upon. Prizes were given to five stokers and lamplighters. Next year's meeting is to be held in Venice.

On the 19th ult., the two Turin Gas Companies invited all the members, with their ladies, to an excursion to Saluzzo and Verzuola; and on the 21st to Mondovi and the grotto of Bassia. Everything went off without a hitch; and, aided by the glorious weather, everybody enjoyed the splendid hospitality of the two Companies. The usual toasts were, of course, proposed and responded to with the greatest enthusiasm. On the 20th ult., the members and their ladies dined together in the Hotel Turin.

REGISTER OF PATENTS.

Governing Gas-Engines.—Grice, H. J., and Rollason, E., of Birmingham. No. 5218; March 13, 1894.

Figs. 1 and 2 are parts of a side and end elevation of a gas-engine constructed according to this patent.

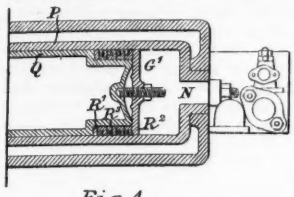

Fig. 1.

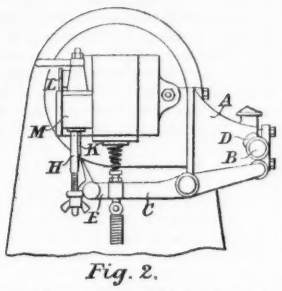

Fig. 2.

A is the end bracket, carrying the side-shaft B, which gives the necessary motion to the lever C, by the cam D, to the admission-valve of the engine. The lever C is extended beyond the length necessary to work the admission-valve (as shown in the illustration at E); and on the end of E a trigger-lever is fitted, having an overhanging lip, which comes into contact with the adjusting nut on the valve-guide H. On the release of the cam, the trigger-lever leaves the face of the valve-guide; the nut acting as a fulcrum for the lip of the lever to work upon. On the boss of the lever, a spring is coiled, having two ends—one end fastens in the lever, and the other end passes through the head of a pin, which acts as a support for the small lever from the side of the lever C. This spring is of sufficient strength to keep the small lever working against the face of the valve-guide H, when the lever C is lifted. It raises the admission-valve; and the lever on the end of C raises the gas-valve K when the engine requires gas. When the valve K is lifted, the gas passing through the tap L is drawn through the valve K into the air-chamber M, and the admission-valve being raised at the same time, it passes on into the cylinder N, when the engine is working at more than its normal speed. This is regulated by the nuts on the guide H.

Fig. 1 is a side elevation of the front of a horizontal gas-engine, showing the water-jacket O, the liner P, and piston Q in section. The piston is designed with rings, and is reduced at the end for the rings in the usual manner; but instead of putting the ring R^2 (which is an ordinary metallic split ring) first, or next to the body of the piston, a ring R^1 is first put on, then a junk ring R3 and a piston ring R^2 alternately, until the space prepared is filled up—finishing with a ring R3. By this method, the loose rings R^2 are prevented from coming into contact with the body of the piston Q and the cover C^1, and, being detachable, can be replaced when worn. The piston and cover, not receiving the thrust, do not require refacing when it is necessary to put in new rings.

Automatic Cut-Offs for Gas Conduits.—Kleine, J., and Lindner, F., of Berlin. No. 5663; March 19, 1894.

This invention relates to "a device for automatically checking a gas, electric, or other conduit after the latter has been open for a certain definite time, so that the medium conveyed by the respective conduit can be consumed but for that time." The object of the invention is, first, to hinder an unduly long use of the respective medium; and, second, to prevent the arising of accidents by leakages of that medium when not in use. This is attained by releasing at the proper time a weight, by the pressure or momentum respectively of which cocks, levers, or equivalents are moved, so that the gas, &c., is turned off.

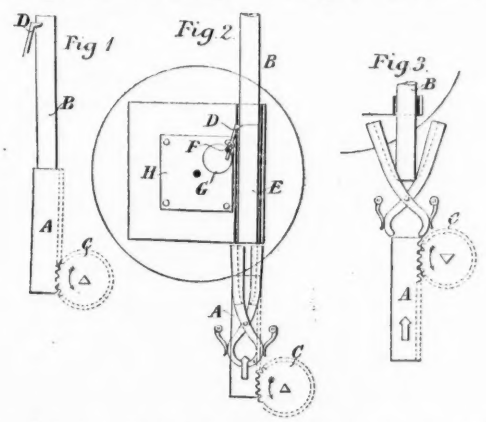

Fig. 1 shows one mode of execution of this device; the clockwork for operatng the click D being left away. Fig. 2 shows it combined with a gas-meter. Fig. 3 depicts the working parts of fig. 2 in another position.

Referring to fig. 1, A is a rack connected with a weight B, and gearing with a cog-wheel C on the shaft or plug of the gas-cock that is to be closed. The weight, and with it the rack, are held in their upper position by a click D, catching into a recess of the weight. This click is acted on by wheel-work (not shown) at the proper predetermined time, so that the parts B and A are then released, and the cog-wheel C is turned, whereby the closure of the gas-cock is effected. The patentees also make use of the momentum of the weight when the latter is falling a certain distance, as in figs. 2 and 3, in which the weight B is guided by a tube E, into which takes the click D. This click is operated by a pin F fixed to the disc G; the latter being slowly rotated by the clockwork H. The rack has a projection with an enlarged head, and is held by the mediation of this head by a pair of pliers secured to any suitable part. The legs are grooved in their inner sides, so as to form an elongation of the space of the guide-tube E. As soon as the weight B is released by the click D, it falls down into the grooves; so that, by the momentum of the weight, and by the action of the latter on the sloping grounds of the grooves, the pliers are opened, as in fig. 3. The rack is thus released by, and disconnected from, the pliers so that by the weight of the rack, the cog-wheel C is turned, and the rack opened.

Registering Automatically the Length of Time during which Street-Lamps have been Burning.—Edwards, E.; a communication from P. Otto, and A. Peycke, of Cuxhaven, Germany. No. 7167; April 10, 1894.

This invention for registering automatically the length of time during which a lamp has been burning, consists essentially of clockwork, the balance or escapement of which is acted upon by a stop or detent when the cock is opened or closed—the stop being coupled with the key of the clock.

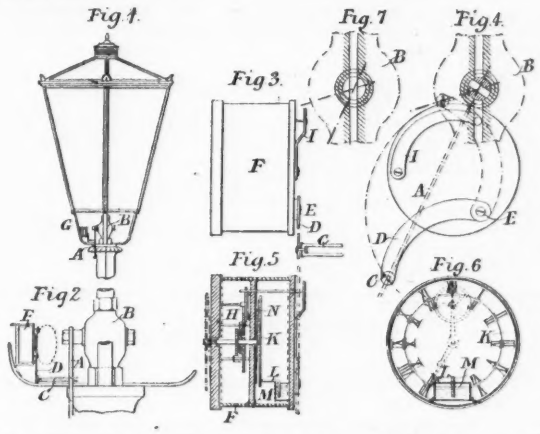

Fig. 1 is a side view, showing the upper part of a lamp provided with the apparatus. Fig. 2 illustrates the lower part of fig. 1 upon a larger scale. Fig. 3 is a side view of the case containing the clockwork by which the registering apparatus is actuated. Fig. 5 is a vertical transverse section, and fig. 6 a vertical longitudinal section, through the case. Fig. 4 is a view, upon a larger scale, of the gas-supply cock and the device by which it is operated (showing the cock closed); and fig. 7 is a similar view, showing the cock open.

The key or lever A of the cock B enters the fork C of a lever D, turning upon a pivot E, fastened to the back of the case F of the apparatus. This case is fastened to the lamp frame G, and encloses the clockwork H. To the back of the case is also fixed a curved spring I, the pin of which reaches into the case. In the terminal position of the lever D (shown by the full lines in fig. 4), the spring I will be without influence—that is to say, its pin does not engage with the balance of the clockwork H. But in the position of the lever D shown by the dotted lines, this pin is pressed in, so that it reaches the balance and stops the clockwork. If now it is supposed that the plug of the cock allows the gas to pass to the burner as long as the lever D is in the position shown by the dotted lines (fig. 4), the clockwork will be arrested as soon as the cock is opened and the lamp is lighted, but is set in motion again by extinguishing the lamp—that is to say, the registering device can only work as long as the flow of the gas remains interrupted.

The arrangement may be modified, so that the registering device works only as long as the lamp is burning. In this case, the bore of the plug of the cock B is arranged in reference to the lever A as shown in fig. 7.

In the arrangement illustrated, the registering device consists of a disc K (figs. 5 and 6), fixed on the axle of the hand or pointer in such a manner that it may be changed without any difficulty. If now the back of the case has been brought into the closed position, the point of a capillary tube L touches this wall; and the tube receives writing fluid from a receptacle M.

Gas Cooking-Stoves.—Raleigh, M., of Balmain, Sydney, Australia. Nos. 8458-59; April 28, 1894.

These inventions relate to that class of gas cooking-stoves heated by means of a perforated pipe for roasting at the bottom, and rings for boiling purposes at the top.

The first invention consists: (1) In dividing the stove into two chambers, placed one over the other; and introducing a horizontal flue between the two chambers, having a vent or draught-hole in the centre of the underside, into which the heated air is drawn when the gas-jets are alight in the bottom of the stove—thus concentrating the heat in the middle of the cooking chamber, where it is most required. When the column of hot air enters the flue, it is split up into several portions, and compelled to travel in circuitous paths under the bottom of the top plate, so as to utilize the heat to the fullest extent, and insure a uniform temperature in the oven. It also increases the deflected heat over the top of the lower chamber, and finally escapes by the vent at the back of the stove in the ordinary manner. (2) In the introduction of a smooth hot-plate on the top of the stove, having the necessary openings, covers, rings, &c., similar to that of a cooking-range. This hot-plate has two atmospheric burners (flattened at the mouth) fixed close under it; and when the gas is lighted, the flame spreads under the plate, and is drawn to the vents or outlets at the left side, through which the heated air escapes. By these means, the

patentee claims to be enabled to boil as many vessels as the hot-plate will hold, and roast a joint of meat under the flame at the same time—thus economizing gas to a considerable degree.

Patent No. 8459 consists: (1) In constructing the stove with one large cooking chamber, having a horizontal flue at the top, so arranged that the heated air is drawn from the sides through a central aperture on the underside of the horizontal flue, and caused to travel on its way to the vent at the back, by several circuitous paths; thus providing a greater, and at the same time a more equable temperature in the cooking chamber, and thereby utilizing the available heat to the greatest extent. (2) In the introduction of a smooth hot-plate on a stove having only one cooking chamber, so arranged that the space between it and the horizontal flue may be utilized for heating plates or dishes, and for toasting, &c. The hot-plate is provided with the necessary openings, covers, rings, &c., similar to that of a cooking-range. It is served by three burners; the one under the front opening being an atmospheric burner, with a flattened mouth, giving a wide flat flame, and the other two under the circular openings at the back being atmospheric burners, with circular rings, perforated around their inner diameter with the necessary jet-holes. To the underside of these rings is affixed a circular plate, pierced with a number of conical holes. This has the effect of breaking up and distributing the ascending column of air, causing "a more complete combustion of the gas, giving a larger area of flame, and so increasing the available heat under the vessel placed over it."

APPLICATIONS FOR LETTERS PATENT.

11,802.—Dawson, H. T., "Gas-engines." June 18.

11,879.—Moore, S. H., Vernon, A. M., and Goodwin, H. J., "Gas-governors." June 19.

11,983.—Mackintosh, J., "Gas or oil engines." June 21.

12,021.—Weuste, C., "Closing and opening gas-pipes or connections." June 21.

12,108.—Dupont, J. L., "Regulators for gas, water, and other fluids." June 22.

12,146.—Bell, J. C., "Street-lamps." June 23.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Gas Companies and the Gas Appliances Trade.

Sir,—Inasmuch as the Messrs. Hersey Bros. do not appear (judging from their letter in your last issue) to fully understand some of the remarks in my recent address to The Gas Institute, it is necessary for me to try and elucidate more fully to them my ideas upon the above very important question now under discussion.

Messrs. Hersey do not seem to understand that gas companies are formed with the object of making money to pay a dividend to the shareholders, and that they are large traders—buying and selling their commodities like other companies (except that they have to conform to certain rules laid down by the Legislature). They secure their profits by the sale of gas, coke, tar, liquor, sulphate, gas-fittings, gas-stoves, &c.; and the more they can get by selling their residuals and by profits on the sale of gas-fittings and stoves, the cheaper can they supply their consumers with gas. My advice, which is founded upon very considerable experience, was that the companies should adopt and use all the most modern and scientific appliances for producing gas, and sell it as cheaply as possible, so that it can be economically used for lighting, cooking, heating, motive power, and all other purposes, and thereby increase their business and usefulness, by which means they would bring their works and distributing plant more fully into play during the daytime, and consequently make them more remunerative to the undertakings.

To attain this very desirable object, I advised that the owners of gas undertakings should try, by every means in their power, to educate their consumers and the public generally as to the best methods of using gas. To this end I recommended them to have well-stocked show-rooms for displaying all the various appliances connected with its use, hold exhibitions with lectures, and do everything possible to increase their business. I pointed out several notable examples where this system had been adopted from the early days of gas lighting, and stated that these undertakings are in the best position at the present time. I also said I believed that the best plan was to sell or let out cooking-stoves upon the three or four years' hire-purchase system. I know there are at the present time gas undertakings which are letting out stoves at too low a rent to make the stove department self-supporting; and the same may probably be the case with the letting out of fittings and prepayment meters. I must confess that, personally, I do not like this system; believing that it is better that each tub should stand on its own bottom.

I hold that the advantages of cooking by gas are so great that, if they were more generally known and understood, a good and fair price could be obtained by the sale or hire of gas appliances. But if some gas undertakings think it best to let out stoves at an unremunerative rental, or if they like to let their customers use them without any charge at all, and simply rely upon the profits derived from the extra sale of gas by their employment, I cannot see upon what principle any special firm or trade has a right to interfere with their policy, and with the way in which they conduct their own business. But it appears that there are some people who think it is a gas company's duty not only to provide profits for their own shareholders, but at the same time to act as philanthropists, and hand over some of their profits to them. Note their language in the following extract from Messrs. Hersey's letter:—

> The fact is the gas companies cannot afford to dispense with the "trade;" and, in their own interests, they must secure their good-will and assistance, in place of the existing animosity and opposition. The solution is a simple one—viz.: The companies ,to act as advisers, exhibitors, and lecturers—thereby creating a public demand—and leave the supply to the proper trading channels. Both parties would then work together in mutual accord, with infinitely more beneficial results to themselves and also to the public, who would be gainers by a wider variety of appliances and systems continually being improved by the impetus that would be given to invention.

I must confess that I do not understand some of these new notions and statements that companies cannot afford this and that they must do that. I was practically engaged with gas companies who carried out the recommendations I have now made; and I never found any material difficulty with the ironmongers. In fact, I have a very strong belief that, when gas companies take a forward movement, it will be an advantage to the trade referred to. As to the existing animosity and opposition which they talk about, it appears to me that their language savours too much of the dog-in-the-manger nonsense; and that it is because those who are engaged in the gas industry are trying to do their own business in their own way that their jealousy has been aroused. They are not wanting in audacity when we find they suggest that a large trader should send out emissaries, lecturers, and, in fact, educate the consumer; and then they suggest that the rest should be left to them, and they will be quite content to pocket the advantages, and live friendly with us. Why one undertaking should cultivate and gather ripe plums (at considerable expense), and hand them over to others without paying for them, I am at a loss to understand.

If conductors of gas undertakings take my advice, they will sell pure gas as cheaply as possible; and both sell and let out stoves, so that they will secure a profit and be self-supporting in themselves, on the same lines that the electrical companies are being worked; for it is well known that, where any dividend has been paid by electrical companies, it has been principally, if not wholly, derived from the sale of the appliances for producing the light.

As for the "trade," they can, and no doubt will, do in the future as they have done in the past—viz., sell stoves and other gas appliances if it answers their purpose to do so, without either the interference of gas companies or any one else; and my opinion is that they will do better for each other by having a free hand. I imagine that the ironmongers did not confer with gas undertakings as to whether they ought to sell electrical apparatus, oil appliances for lighting, heating, or cooking, coal or coke cooking-ranges, &c.; and why they should now presume to think or ask that gas undertakings should hand over their business to them, under the existing conditions, in this age of light and free trade, is past my comprehension.

John West.

Manchester, June 30, 1894.

Mr. Newbigging's Gas Institute Paper.

Sir,—Mr. Newbigging's paper, read at the recent meeting of the Incorporated Gas Institute, is evidence of a growth of opinion in favour of a lower standard of illuminating power since this was advocated by me in 1892, both in my presidential address to the members of the Incorporated Institution of Gas Engineers, and also in a letter to the Journal on the occasion of the announcement by The Gaslight and Coke Company of their intention to abandon the manufacture of cannel gas; and the recent experiment made by the South Metropolitan Gas Company, of supplying to their consumers gas made in the usual way, from common coal alone, must have done much, in a very practical way, to advance the movement. Moreover, the rapid extension of incandescent lighting promises to afford an additional and still more powerful reason to those hitherto existing in favour of it; since this system requires only a good heating gas. It can hardly, however, be desirable to complicate the economic argument by endeavouring to convince the consumer that, using ordinary burners, he can see as well with 14-candle as with 16-candle gas, or that the former is as good as the latter for heating or for motive power.

The case for a low quality of gas rests upon more solid ground. The comparative loss of lighting effect resulting from the very rich gas, coupled with the fact from which consumers for lighting and heating suffer alike—that "it is the last candle that costs"—constitute reasons for the change, which, when fairly urged, should prove irresistible.

Charles Hunt.

Birmingham, June 30, 1894.

Coin Meter Supply of Gas and Fittings.

Sir,—How can Mr. Cranmer justify his deductions for meter-rent, which in all three of his illustrations (p. 1176 of June 19) converts the profit balance into a loss? As he charges interest on capital and wear and tear and depreciation of the coin meters, he cannot possibly debit consumers with meter-rent, 2s., assumed to be lost. This is a fallacy.

A still greater fallacy is the assumption that the average consumer will only burn 6000 cubic feet of gas. In this part of the world, the consumer looks like burning at least 12,000 cubic feet; and with further development of his habit of using gas, and the temptation of a possible further reduction in price, no doubt a larger use will accrue—fuel to wit.

Moreover, he should not debit the total cost of manufacture and distribution upon the consumption, inasmuch as he has already anticipated the wear and tear of the iron service-pipe, the supply-pipe, and the main cock, and the wear and tear of the meter—all of which enter into the 2s. he takes, to say nothing of the reduction of fixed expenditure per 1000 cubic feet by this extension of the use of gas.

Hy. E. Jones.

Gas-Works, Stepney, June 25, 1894.

Wire-Ropes as Guides for Gasholders.

Sir,—How far from the truth is the statement of Messrs. Clayton, Son, and Co., Limited, that "ropes as guides are absolutely unnecessary and of no use whatever in the guiding of gasholders," is well known to gas engineers, whatever may be the true state of the knowledge of gasholder builders.

Ashmore, Benson, Pease, and Co., Limited

Stockton-on-Tees, June 28, 1894.

Sir,—It is with no desire to start a controversy in the Journal columns that I take the liberty of replying to part of the letter from

Messrs. Clayton, Son, and Co., Limited, which appears in your current issue. But I cannot allow their unqualified assertion to pass—that "ropes as guides are absolutely unnecessary, and of no use whatever in the guiding of gasholders."

I grant them that, as soon as either the top or the second lift in a holder is cupped, it has to carry the weight of all the lower lifts; and by reason of this it is kept in a perfectly rigid and stable condition. But from the moment when the bottom curb of either lift leaves the resting-stones till the cupping takes place, it is absolutely necessary that means of guiding be present; and the large number of gasholders now working with wire-ropes as guides—some of them for four or five years—has firmly established the fact that these ropes are of use, and more than that, it is proved that the holders rise and fall with greater steadiness, especially in a gale of wind.

15, *Victoria Street, S.W., June* 29, 1894. C. J. BROWN.

The Large New Gasholder at East Greenwich.

SIR,—In your issue of June 19, you have misreported certain remarks made by me at a meeting of the Middlesbrough Town Council; and Messrs. Clayton, Son, and Co., Limited, have commented upon your report and a statement extracted from the local papers, which also is not as made by me, in your issue of June 26.

What I did say was: "Since the opinion which had been quoted was given by Mr. Livesey, he had erected a gasholder, with a diameter of 300 feet, of 12 million cubic feet capacity, the two top lifts of which were unguided; and they had withstood the storms of last winter. When the two top lifts of such a holder were left free, surely a rope-guided holder must be as safe as a column-guided one." I regret that you have been led into error through following the report of the local papers, and that through the same report Messrs. Clayton should be drawn into making innuendoes which I am sure they will hasten to withdraw now that they see the correct version of my remarks.

Grove Hill, Middlesbrough, June 27, 1894. W. L. TAYLOR.

The Salisbury Electric Light and Supply Company, Limited, has been registered with a capital of £20,000, in £1 shares, to produce and supply electric current for light or power in the city of Salisbury.

Complaints as to Increased Gas Consumption at Huddersfield.—Included in the minutes submitted by the Gas Committee at the meeting of the Huddersfield County Council at their meeting on the 20th ult., was a report by the Gas Engineer (Mr. W. R. Herring) relating to complaints from consumers as to excessive accounts in respect of the gas supplied during the six months ending March last. He stated that, since the accounts were rendered, 220 complaints had been received and investigated. Of these 127 compared favourably as regarded consumption with the previous corresponding period; and in 47 cases the consumption was actually less. The total number of consumers was 18,500; so that, in comparison, the number of complaints was not large. He pointed out further that the increase in consumption had not, during the period in question, been general; and, indeed, the total increase of output had only been 1¾ per cent., as compared with a normal increase per annum of 5 per cent. for many years past. It was, he remarked, obvious, from these considerations, that the increases in the cases complained of were owing solely to causes arising within the respective consumers' premises. Alluding to the charge that "greater pressure in the mains" was responsible for the increase, Mr. Herring said it had been the same as during the previous winter; and regarding the allegation that the gas had been "adulterated," he observed that the ordinary coal gas had been enriched by the admixture of about 1½ per cent. of gas made from oil and oxygen. This had resulted in the distribution of a better quality of gas, but could not have affected the rate of the passage of the gas through the burners. The adoption of the process had been common to the whole district of supply; and, as in the case of the previous suggestion as to increased pressure, must, if it resulted in increased consumption, have affected all consumers alike. The average illuminating power of the gas, as tested day by day, was 18·17 candles, as compared with the average of 17·03 candles in the winter of 1892-3. The minutes were passed.

Seville Water-Works Company, Limited.—The annual meeting of this Company was held last Tuesday, at the London Offices, 86, Cannon Street, E.C.; Mr. D. Evans presiding. The Secretary (Mr. J. M. Hamilton) read the notice convening the meeting; and the report and accounts for the year ending March 31 last were then submitted. The former showed that the income from all sources amounted to £27,639; and after deducting working expenses, the cost of laying on services, exchange differences, and debenture interest, the net revenue was £9323, as compared with £9579 in the preceding year, although the increased currency profit was 18,121 pesetas. To this was added the unappropriated profit at March 31, 1893—viz., £558; and after charging stamp duty and commission on debentures, the contribution to the sinking fund of £588, and the interim dividend, the amount standing to the credit of the profit and loss account was £5184. The Directors recommended that a balance-dividend, at the rate of 3 per cent. per annum, free of income-tax, be paid for the past half year, which would absorb £4066, and leave £1118 to be carried forward. The Chairman, in moving the adoption of the report, said the Directors extremely regretted that they were not in a position to pay the usual dividend; the principal cause of this being the difficulty of exchange. If the exchange had remained at 26·50 pesetas to the pound, or something like that, they would have been able to pay 4½ per cent. dividend. As it was, they had lost 20 per cent. of their income through the effect of changing silver into gold. The expenses for maintenance and repairs and the pumping and engine charges had increased. The former was due to the repairing of meters, and some expenditure on pipes; and the latter, to the great quantity of water pumped and the increased cost of coal owing to the strike. Besides these increases, the growth of the income had caused the commission on the collections to be rather larger. Mr. Cowley Lambert seconded the motion, which was agreed to; and afterwards resolutions were passed, re-electing the retiring Directors (Messrs. Horner and Lambert) and the Auditors.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Friday, June 29.

LONDON WATER SUPPLY.

The East London, Southwark and Vauxhall, and West Middlesex Water Bills having been read a second time,

Lord BALFOUR moved—"That it be an instruction to the Committee to which these Bills shall be referred not to proceed with any clauses which will interfere with the arrangement of a comprehensive scheme for increasing the water supply of the Metropolitan district on the lines indicated in the report of the Royal Commission presented last year." He said he had not opposed the second reading of the Bills, because he heartily approved of some of the purposes they were intended to effect. Immense interests were, however, involved; and to send the Bills to a Select Committee without special instructions would not be a satisfactory method of dealing with them. There were questions of general policy involved in the passage of these measures through Parliament. The inquiry of the Royal Commission on the London Water Supply had embraced these two points: (1) Was there a sufficient quantity of water in the valleys of the Thames and the Lea to provide for the necessities of the Metropolitan district in the future, having regard to other interests? and (2) Could that water be presented for consumption in an adequate state of purity? Speaking generally, the Commission answered these two questions in the affirmative. The quality of water depended largely on the amount of storeage accommodation; and in so far as these Bills went to provide more storeage and more efficient filtration, they ought to receive the hearty approval of the House, provided that, at this particular juncture, nothing more should be done than was absolutely necessary, and that no future settlement of the question should be prejudiced. The report of the Commission was equally emphatic as to the quantity of the water. But it might be necessary in the future to draw a larger quantity of water out of the Thames. With respect to this matter, the Commission recommended, among other things, that, if more water were taken out, it should only be done in conjunction with the provision of additional storeage reservoirs for providing compensation water for the river. The Southwark and Vauxhall Water Bill, as introduced into the House of Commons, made immediate provision for taking more water out of the Thames, but none for more storeage reservoirs; but this was struck out of the Bill. Apprehension existed that, if this Bill were allowed to pass in its entirety, when the larger question came to be decided the Company would be in a position of too great independence, and would not be inclined to join in any comprehensive scheme which might be promoted by the other Companies. At present the dry-weather flow over Teddington Weir was 150 million gallons a day; but if the proposals of the Commission were carried out, more water might be taken from the Thames and the dry-weather flow never be reduced below 200 million gallons. They were told by the London County Council that they proposed next session to introduce a scheme into Parliament for acquiring the undertakings of the Water Companies; and they were also told that some of the Companies proposed to bring forward a comprehensive scheme. His object, therefore, was to prevent the fair discussion of these greater questions in Parliament next session from being prejudiced by the passage of the Bills promoted this session. No Company taking water from the Thames should be put in a position which would relieve them of the necessity of contributing to the general storeage and compensation reservoirs; and it was of paramount importance to the County Council and the ratepayers that no power should be given to the Companies to spend more money than was absolutely necessary.

The Earl of MORLEY said no one in the House was better entitled to express an opinion upon this question than the noble Lord who presided with so much ability over the Royal Commission. He entirely sympathized with the object of the noble Lord; but he would venture to ask whether it would not be attained by his having drawn attention to the points he had dealt with. It was not the practice of the House to move instructions to Committees on Private Bills; and he was sure the suggestions made would be taken into consideration without passing an instruction. He would also point out that the instruction was in such general terms that the Committee would have considerable difficulty in knowing how to deal with it. The Bills in question did not imply a very large amount of work. The West Middlesex was almost entirely a Money Bill; the East London Bill asked for authority to construct storeage reservoirs, and to raise money for the purpose; and the Southwark and Vauxhall Bill asked for the same powers on a somewhat larger scale. The purposes for which the £750,000 authorized by the Bill was to be expended were much more clearly defined by the Committee to which the Bill was referred in another place. This might meet some of the objections of the noble Lord. But he was very far from saying that the Bill would not require careful consideration by any Committee of that House; and he was sure such a Committee would fully attend to the indications given.

The Marquis of SALISBURY agreed with what the Chairman of Committees had said, and considered that the motion went too far.

The motion was withdrawn.

The following progress has been made with Bills:—

Bills read the first time, and referred to the Examiners: East London Water Bill, Southwark and Vauxhall Water Bill, West Middlesex Water Bill.

Bills read a second time and committed: Colne Valley and Central Middlesex Water Companies Bill, East London Water Bill, Harrow and Stanmore Gas Bill, Hebden Bridge Gas Bill, Preston Gas Bill, Southwark and Vauxhall Water Bill, Wakefield Corporation Bill, West Middlesex Water Bill.

Bill reported: Gloucester Corporation Bill.

Bills read the third time and passed: Bury Corporation Bill, Consett Water Bill, Dundee Corporation Bill, South Hants Water Bill.

The opposition to the Plymouth and Stonehouse Gas Bill has been withdrawn.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bill read the first time, and referred to the Examiners: Consett Water Bill.

Bills read a second time and committed: Accrington District Gas and Water Board Bill, Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

Bill reported, with amendments: Pontypridd Water (Tramroad) Bill.

Bills read the third time and passed: Abertillery Local Board Gas and Water Bill, Bacup Corporation Water Bill, East London Water Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Newcastle and Gateshead Water Bill, Southwark and Vauxhall Water Bill, Swinton Local Board Bill, West Middlesex Water Bill.

Exhibitions of Gas Appliances.—The Davis Gas-Stove Company, Limited, held an exhibition of their gas appliances in the Broadway Hall, Crouch End, from Tuesday to Friday last week, with the co-operation of Miss Adelaida A. Hunt as lecturer on cookery.——Messrs. W. Parkinson and Co. held a successful gas exhibition in the Public Hall, Smethwick, from Monday to Friday last week; Miss Edith Sanderson giving cookery lectures twice daily. It was held under the auspices of the Local Board; the Chairman (Mr. J. Newey) performing the opening ceremony, and the Engineer and Manager (Mr. B. W. Smith) being among those present.

Coventry Corporation Gas Accounts.—The statement of accounts of the Coventry Corporation Gas Department for the year ending March 25 last has just been published. The capital stands at £207,420; and the fixed plant account shows a total expenditure of £196,414, of which £375 has been spent during the year—the balance in hand being £11,005. The revenue account shows a total expenditure of £41,748, and receipts amounting to £54,783; the profit being £13,035, which, with £133 interest on reserve fund investment, makes a total of £13,168. Of this, £1462 has been paid to the sinking fund; income-tax and interest on capital absorbs £8456; and the amount transferred to the general district fund is £930—leaving a balance of £2319. The quantity of gas made during the year was 335,987,000 cubic feet, against 329,290,000 cubic feet in the previous year.

Enlargement of the Radstock Local Board Water-Works.—The Radstock Local Board having applied to the Local Government Board for sanction to borrow £5000 for works of water supply, an inquiry into the matter was held, on Tuesday last, by Major-General C. Phipps Carey, R.E. In the course of the evidence, it was stated that about £2000 had been already expended, a reservoir was nearly completed, and some of the mains laid. A letter was read from the Frome Rural Sanitary Authority, objecting to the water-mains being carried through any of the parishes under their control, unless the Radstock Board agreed to place six hydrants on the portion of the main in their district, with the free use of water for fire and steam-roller purposes, and supplied the Authority with not exceeding 15,000 gallons of water per day. It was mentioned on behalf of the Board that they had offered to furnish the Authority with 15,000 gallons of water per 24 hours, at the rate of 6d. per 1000 gallons. Notice of opposition had been received from other sources; but it was stated that terms had been arranged.

The New Water Scheme for Gloucester.—The members of the Gloucester City Council were mainly occupied at their meeting last Tuesday in considering a long report by the Parliamentary Committee on the Corporation Bill, part 2 of which contains 25 clauses relating to the provision of additional water-works. The Committee stated that they had entered into an agreement with the owners of the Onslow Estates, near Newcut, where the proposed new well and the principal portions of the galleries and driftways will be; and they had agreed to grant and convey to the Corporation a field containing about 3 acres as a site for the proposed well and pumping-station, together with other rights and advantages, in consideration of the Corporation agreeing to furnish, through meters, a fair and reasonable quantity of water for three groups of properties at the rate of 1s. per 1000 gallons, the Corporation to pay £50 towards the costs and charges of the surveyor and engineer of the grantors, and £150 for the costs, &c., of their Solicitor. An agreement had also been entered into with the Rural Sanitary Authority, whereby the Corporation undertook to supply Newent with water up to 25,000 gallons a day, at the rate of 7d. per 1000 gallons, and any larger quantity which the Corporation might be able to spare at the rate of 1s. per 1000 gallons; and Oxenhall, Dymock, and Pauntley, up to 15,000 gallons, at the same rates. With reference to the financial provisions of the Bill, the Committee stated that the Corporation are required to repay the money borrowed for water-works purposes within fifty years, and money borrowed for the payment of the costs of the Act within five years from the date of borrowing. A recommendation that the Engineer (Mr. W. Fox) be at once instructed to proceed with the preparation of the requisite drawings and specifications led to a statement as to his proposals regarding the manner in which the works should be carried out, and respecting the expediency of laying down a larger pumping-main and more powerful machinery. In the first place, he suggested that contract No. 1 should be made for well sinking and tunnelling (if necessary); and as soon as the result showed that the desired quantity of water was met with, contracts for the rest of the work should be entered into. The parliamentary estimate included a 12-inch pumping-main, having a delivering capacity of 300,000 gallons in ten hours; and Mr. Fox recommended that this should be enlarged to 14 inches, which would deliver 600,000 gallons in twelve hours—the extra cost being only about £500. With a view to economy, he also proposed that, in inviting tenders for pumping machinery, the contractors should give prices for one engine or a pair erected at the same time, in order that the Committee might be able to judge whether it was worth while erecting, in the first instance, two engines, each capable of pumping 300,000 gallons in ten hours. The report was adopted.

MISCELLANEOUS NEWS.

MANCHESTER CORPORATION GAS AND ELECTRIC LIGHT SUPPLY.

Annual Reports.

The annual reports on the Gas and Electric Lighting Departments of the Manchester Corporation will to-morrow (Wednesday) be presented to the City Council for adoption. We are favoured with advance copies, from which we make the following extracts:—

The operations of the Gas Department for the year ended March last have been seriously interfered with by the disastrous coal strike, which lasted 16 weeks (from July 29 to Nov. 17, 1893); and although the Committee had in stock a full three months' supply, it became requisite to purchase a large quantity of coal and cannel at greatly enhanced prices. The percentage of cannel used was 48·8, as against 51·7 in the previous year. The estimated results have been still further interfered with by the unusually bright weather during the greater part of the year, the almost entire absence of fogs in the winter months, and the extended use of the electric light. These causes combined have resulted in a decrease of 2·82 per cent. in the consumption of gas, instead of an estimated increase of about 3 per cent. The following statement shows the quantity of coal and cannel carbonized during the past year as compared with the previous year:—

	Coal and Cannel Carbonized. Tons.	Gas Made per Ton. Cubic Feet.	Gas Sent Out from the Works. Cubic Feet.	Gas Unaccounted for. Cubic Feet.	Percentage of Loss.
1894	360,654	9,802	3,532,035,000	112,910,000	3·2
1893	365,235	9,957	3,634,690,000	130,730,000	3 6

The average illuminating power of the gas sent from the works was equivalent to 19·04 sperm candles, as against 19·11 candles for the previous year. The following statement shows the quantity of coke, tar, and ammoniacal liquor made during the year, as compared with the year 1892-3.

	Tar.		Ammoniacal Liquor.		Coke.	
	Total Quantity. Tons.	Yield per Ton. Gallons.	Total Quantity 10-oz. Strength. Gallons.	Yield per Ton. Gallons.	Total Quantity. Tons.	Yield per Ton. Cwt.
1894	21,990	11 50	9,142,616	25·35	235,474	13·06
1893	24,500	13 08	9,259,268	25·35	229,695	12·58

The number of consumers in the city was 65,886; and beyond the city, 15,751—making a total of 81,637, or 204 more than in the previous year. The average consumption of gas per consumer in the city was 40,974 cubic feet; and beyond the city, 26,632 cubic feet. The number of gas fires and cookers in use was 6160, and the number of gas-engines 858, as compared with 5302 and 716 respectively for the year ended March 31, 1893. The quantity of gas used in these appliances is estimated at 162 million cubic feet; being an increase of 13·3 per cent. The number of prepayment meters in use at the end of the financial year was 525; being an increase of 316. The quantity of gas consumed by these meters was 2,392,500 cubic feet—an increase of 1,157,350 cubic feet, or 93·7 per cent. on the previous year.

The total amount of revenue was £569,031 14s. 5d., as compared with £555,564 12s. 7d. in 1892-3; being an increase of £13,467 1s. 10d., or 2·42 per cent. The amounts received for gas-rentals, meter-rents, stove-hire, and residual products respectively were as follows:—

	Year 1893-4.	Year 1892-3.
Gas-rents within the city	£348,695	£361,321
„ beyond the city	70,926	69,196
City fund for street lighting	44,877	42,828
Coke	53,211	37,408
Tar	18,270	21,122
Ammonia water	32,774	23,375

Under the head of expenditure, the Committee had to pay for cannel and coal, including the cost of unloading, the sum of £293,280 10s., against £248,718 8s. 3d. for 1892-3; being an increase of £44,562 1s. 9d. The gross profit on the year's working is £72,775 17s. 3d. After paying £28,232 5s. 1d. for interest, and placing £13,954 to the sinking fund (as required by the Acts of Parliament under which the money is borrowed), the net profit amounts to £30,589 12s. 2d. As the Committee were required to pay the sum of £64,321 to the city fund, the balance of £33,731 7s. 10d. has had to be taken from the contingent fund to make up the amount. The whole of the works and plant have been kept in a state of thorough repair out of revenue.

As to extensions and renewals of works in progress, it is stated that the new gasholder which has been erected at the Gaythorn works has not yet been brought into use, in consequence of the serious leakage of water from the tank, which is constructed in extremely porous red sandstone. Mr. Hill has been consulted in the matter; and, under his direction, in conjunction with Mr. G. E. Stevenson (the Committee's Engineer), means have been adopted which it is confidently anticipated will result in overcoming the difficulties, and making the holder fully available for next winter, and be the means of securing a good supply of gas to the districts south and west of the city. At the Rochdale Road station, in addition to the usual renewals and repairs to works and plant, the stack of the B retort-house has been taken down, and the furnaces have been reconstructed, with increased capacity, on the regenerator principle. The eight old purifiers known as the C section are being replaced by four large purifiers, each 50 feet long, 30 feet wide, and 6 feet deep, increasing the area for dealing with the gas from 4608 to 6048 square feet. These new purifiers, fitted with patent valves of the best description, are being erected on a stage, so that space will be available underneath for a revivifying floor, which is much wanted. A new condenser, Livesey washer, and two washer-scrubbers, each to deal with 4 million cubic feet of gas per 24 hours, are nearly completed. Two old boilers have been replaced by others of the Lancashire type, 28 feet long by 7 ft. 6 in. diameter. The carpenters' shop has been removed from its former cramped and unsuitable position to a more convenient site, where work can be carried on under better supervision, and with greater economy and efficiency; and new planing, sawing,

and morticing machines, to be worked by two 10-horse power gas-engines, have been obtained. At the Bradford Road station, the construction of the tank for the large gasholder has proceeded satisfactorily; and preparation is being made for the early erection of the holder on the completion of the tank. It is hoped that this holder, to contain 7 million cubic feet of gas, and to cost with the tank £66,000, will be completed ready for the winter of 1895; and, with the addition of the new holder at Gaythorn, it will place the gas-works of the city in a favourable position as to storeage capacity. Machinery for charging and drawing, worked by compressed air, and on the most approved principle, has been provided for the No. 1 retort-house, and is working satisfactorily. The contracts for offices, stables, stores, and mechanics' workshops have also been let, and the work is making good progress. The works at Droylsden are regarded by the Committee mainly as an experimental station; and the settings of inclined retorts have been at work during the past year. The new holder, to contain 525,000 cubic feet of gas, was completed in December, 1893. In the distribution department, in addition to a large number of new mains laid down to meet the increased demand, and to equalize the supply of gas, extensive renewals of old mains and service-pipes have been carried out.

With regard to the electric lighting works, which are also under the control of the Gas Committee, the following particulars are furnished: The buildings, boilers, engines, dynamos, and other plant referred to in the report of last year have been completed, and the supply of current was commenced on July 31, 1893. The number of consumers at the close of the year was 412. The number of incandescent lamps in use was 18,478; of arc lamps, 250; and of motors, 11 (representing 16-horse power). The total quantity of current supplied and charged for was 439,379 units; and the amount of revenue from both methods of charge, including fixed charges per lamp and rate per unit consumed, was £10,067, which works out to about 5½d. per unit. The amount for which borrowing powers have been obtained is £150,000, and of this sum £127,830 had been raised. The amount of capital expenditure to March 31, 1894, less £610 interest on loans during construction transferred to revenue account, was £127,374. The total amount of revenue from sales of current and rental of meters was £10,198. The cost of generation, distribution, and management was £5509. To this must be added the interest from the commencement of the undertaking, bankers' commission, and sinking fund; leaving a debit balance of £209 to be carried forward. The generating plant in operation was estimated to supply an average of about 20,000 16-candle power incandescent lamps, and to be quite equal to any demand which would be likely to be made upon it for two years or more. So numerous, however, have been the applications that the plant is already loaded to its full capacity; and it was found that without extension there would be difficulty in fully supplying the demand next winter. Under these circumstances, it was decided to extend the plant by one Lancashire boiler, two 360-horse power vertical compound condensing engines, and two large dynamos. These works are now in progress; and they will be available for next winter. The new offices, workshops, and store-rooms are also rapidly approaching completion. The applications for a supply of current outside the present area are so numerous that the Committee have decided to make inquiry, and on a future day to report to the Council as to the desirableness of laying mains in certain leading thoroughfares, and of providing the additional plant and machinery required to generate the current for which, they say, there is every probability of a great demand.

PLYMOUTH AND STONEHOUSE GAS COMPANY.

The Annual Meeting of this Company was held last Thursday—Mr. G. HENDERSON presiding.

The CHAIRMAN, at the outset, made a statement respecting the Company's Bill now before Parliament, and complained that the Corporation had opposed them without due consideration. He said that if, on examining the Bill, the Special Purposes Committee of the Corporation felt that some modifications were necessary, their reasonable course—and, indeed, their duty—was to approach the Company with the view to arriving at some arrangement satisfactory to both parties, and so avoiding a large expenditure of the rates without any advantage whatever. In their petition against the Bill, the Corporation alleged that they represented the consumers of gas within the borough. In his evidence before the Committee of the House of Commons, he ventured to state that the opposition did not emanate from the general body of consumers, but that, on the contrary, a very large number of them approved of the course the Company were taking. He was perfectly justified in making this statement; for although there were upwards of 11,000 consumers of gas, not a single one gave evidence in opposition to the Bill, and the Corporation did not even call Mr. Corbet Woodall, on whose report, it was said, the petition was mainly based. The Corporation petitioned for an increase in the illuminating power of the gas from 14 to 16 candles. But Mr. Woodall, in his report, only recommended an increase to 15 candles; and the Corporation, through their Counsel, were obliged to confess that they would be perfectly satisfied with this standard. It was really of no benefit to the consumers that the standard should be 16 candles. On the contrary, it would be a disadvantage to a large number of those who required gas for engines and heating purposes. With regard to capital, the Company asked for power to raise £180,000. But they were quite content with the £150,000 at which it had been fixed by the House of Commons Committee; and the Directors hoped it would be sufficient for many years to come. Objection was taken by the petitioners to the amount the Company had carried over as undivided profits. Mr. Balfour Browne called it a second reserve fund. It was not that, however, but a balance available in case of emergency. If they had not had this balance during the past four years, they would, in all probability, have had to put up the price of gas. It was sound policy to create such a fund to guard against contingencies. Mr. Balfour Browne asked the Committee to put an end to that fund; and he argued that a reserve of £1000 would be ample. The Committee, however, gave the Company power to carry over £10,000. In addition to that reserve, they had an insurance fund, on which they had not yet drawn, but which was available for contingencies; and it was possible they might in future make use of it. Another contention was that, having regard to the large dividends, the standard price was excessive, and, in justice to the consumers, should be reduced. But Mr. Woodall did not advise any such reduction. To his credit, he refused to give evidence in favour of cutting down the standard price. The whole gist of Mr. Balfour Browne's speech was that the Company had been too successful, that they had been supplying gas at too low a price, and had been paying large dividends. Mr. Browne asked the Committee not to let the Company pay 12 and 9 per cent. dividends. But Mr. Browne ought to have been aware that the whole of the capital authorized by the Act of 1879 was sold by public auction; and shares nominally worth £30,000 realized £60,000. Consequently, holders of those shares were receiving only £4 12s. 6d. per cent. on their investment. While increasing the illuminating power of the gas to 15 candles, the Parliamentary Committee decided that their standard price of 2s. 6d., which was the lowest in the kingdom, should not be altered. The attempt on the part of the Corporation to cut down the standard price was most unjustifiable; for they wished to deprive between 500 and 600 shareholders in that Company of the dividends they were legally and honestly entitled to receive. Most of the shareholders were residents in Plymouth, and a very large proportion were consumers of gas; and the action of the Corporation was an attempt to confiscate their property to the extent of some £30,000 or £40,000. If the opposition had succeeded in reducing the standard price to 2s., it would have meant a reduction in their dividends by 1½ per cent.; and he felt that no language was too strong to condemn the action of the Corporation.

From the report of the Directors, which was then submitted, it appeared that, after payment of the authorized dividend in January last, there remained a balance to the credit of the profit and loss account of £23,458, from which the Directors recommended the payment of a dividend for the half year ending March 31 last of 12s. 3d. per share on the original shares, 9s. 9d. per share on the additional shares, and 9s. 3d. per share on the new shares (Act 1879), free of income-tax. This would absorb £3984, and leave a balance of £17,474 to be carried to the credit of the next account. They stated that the favourable contract made last year for the supply of coals, combined with the improved prices obtained for sulphate of ammonia, had beneficially affected the working accounts for the year, and placed the Company in a position to pay the full authorized dividend, and leave a sum to be carried forward.

The CHAIRMAN, in moving the adoption of the report, said it was now 50 years since they obtained their first Act of Parliament; and it was a great source of satisfaction to the Directors to be able, in their jubilee year, to place before the proprietors accounts so satisfactory. The gas-rental had increased during the past year by £2062; and the receipts from residual products, by £1800—the total revenue having been £81,642, compared with £78,157 in the previous year. These figures were very gratifying. On the debit side, their consumption of coal was 62,176 tons, against 60,130 tons in the previous year—an increase of 2046 tons. Notwithstanding the extra consumption, there had been a saving under the head of coals of £3198. The result of the year's working had been a profit of £14,681, compared with £8450—an increase of £6230. This enabled them not only to pay the full dividend on all classes of shares out of the profits of the year, but also to carry a balance forward.

Mr. R. H. SNOW seconded the motion, which was carried.

On the proposition of the CHAIRMAN, the dividend recommended was declared; and it was decided that on Jan. 1 next a dividend of 6⅛ per cent. should be paid on the consolidated stock.

Mr. HARVEY, a shareholder, asked if there was any ground for the statement made at the last Council meeting that the gas-lamps belonged to the Corporation.

The CHAIRMAN should say not, for the Company had paid for them.

The usual votes of thanks were then accorded, and the proceedings terminated.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Annual General Meeting of this Company was held on Thursday last, at the Cannon Street Hotel, E.C.—Admiral Sir Edward Inglefield, K.C.B., presiding. The notice convening the meeting was read by the Secretary (Mr. L. de Fonblanque); and afterwards the Directors' report, the principal points in which were given in the JOURNAL last week, was read by the Chairman, who moved its adoption without comment. The motion having been seconded, considerable discussion followed. The first speaker was Mr. Elkan, who said he failed to find in the accounts the balance of profit of £12,723. He also noticed that the Directors were going to issue the remaining £12,000 of debentures; but he pointed out that, by doing this, they incurred the responsibility of having to pay 6 per cent. interest. Instead of issuing the debentures, why, he asked, should they not utilize the profit-balance. Mr. Ross, having remarked upon the splendid results of the working during the past year, appealed to the Directors to consider whether something could not be done to place the ordinary shareholders on a more equitable footing. He said he was an ordinary shareholder, and was getting about ½ per cent. on his investment; while the preference shareholders were realizing something like 1000 per cent. Mr. S. Spencer suggested that the 661 unissued preference shares should be issued *pro ratâ* to the ordinary shareholders, so as to reduce the amount of the debentures to be issued, and also help to make up in some way the loss incurred by the ordinary shareholders. The Secretary, replying to the first speaker, said the profit-balance of £12,723 was obtained by deducting the dividends—amounting to some £10,000—from the profit of £23,072 shown in the profit and loss account. The Chairman, referring to the proposed issue of debentures, stated that it was very necessary to have a good amount of working capital in hand, as they required a large stock of the solution they used, for which they had to pay in advance; and alluding to a reference to the commission which had been paid to the Manager and Chemist (£5180), he stated that this was in accordance with the agreement entered into at the time the

Company were in almost a shipwrecked condition, and, in his opinion, it was richly deserved. The Solicitor (Mr. Francis) stated, as to the unissued preference shares, that under resolutions passed, he believed, in 1890, those shares were absolutely pinned to, and formed part of, the 5 per cent. debenture issue. He was quite in sympathy with the gentleman who asked that some further advantage should be given to the ordinary shareholders. This question had been considered by him from all points; but he found it was surrounded by a great number of difficulties. A scheme, however, would have to be matured sooner or later; and he should be glad to receive any suggestions on the subject. Answering a question as to the security for the debentures, the Manager (Mr. J. Moeller) said he thought the patent in itself was sufficient security; and he supported his opinion by these facts: About three years ago, the Company sold the Italian patent for £6000. Certain circumstances arose some three months ago which made it desirable that they should get that patent back under the influence of the English Company; and he tried hard to obtain it again. He went to Rome, and offered £60,000, but did not succeed in acquiring it. That patent ran on to 1901. In Italy there were only about 24 towns lighted by gas which used the incandescent lights; so that, when this was compared with England, he considered there was ample security for the debentures. The French patent, too, was sold for £12,000. A Company was formed in France with a capital of 800,000 frs.; and they made nearly 2 million frs. the first year. Last year they (the English Company) were greatly hampered for want of funds. Their turnover was about £80,000; while the available cash-balance was only £4000. They were now anticipating a much larger turnover; and consequently they must have more money. He also referred to the new factory which the Company are building; and, later in the proceedings, he stated that they were now negotiating with Mr. Corbet Woodall, who was connected with various gas-works in Cape Colony, for the working of the Company's patents there. Replying to Colonel Mundy, he said that a Syndicate had been formed for working the Helio Bec incandescent light. It was nothing, however, but an infringement of their own system and the patent of Dr. Welsbach. The burner had only been advertised in this country; but at present there was no infringement here. The report was adopted; and afterwards the retiring Director (Major Jones) and the Auditors were re-elected.

BELGRANO (BUENOS AYRES) GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at Winchester House, Old Broad Street, E.C.—Mr. C. P. Ogilvie in the chair.

The Secretary (Mr. H. T. Adkins) read the notice calling the meeting; and the Directors' report for 1893 was then taken as read. It stated that the collection of outstanding accounts compared favourably with the previous year; and the municipal accounts had been reduced by $50,000 currency. After deducting debenture interest, and providing fully for depreciation in the sterling value of the liquid assets on Dec. 31, 1893, the net profit amounted to £6369; and this reduced the balance at the debit of profit and loss to £906.

The Chairman commenced his remarks by referring, with sorrow, to the death, on the previous Sunday, of one of the Directors (Mr. J. T. Wooley). Proceeding, he said that, as a whole, he thought the shareholders would find the present report a satisfactory one. The gold premium, of course, had led to some considerable anxiety; and he gave expression to the opinion that all English Companies who invested gold in the Argentina should be paid in gold. When the gold premium was at a high figure in 1891, and towards the end of 1892 it dropped, the Companies agreed to a sliding-scale of charges, so that their prices would go up and down according to the premium on gold. But in places where there were a number of gas companies working, it would be found that one of them was in a better position than the others—one was pretty sure to have an advantage in the supply of gas; and it was in this case that one particular company who did not increase their rates when the premium began to rise. He could not, of course, say, as a matter of fact, that they did not advance their rates in the hope that the other Companies would, and in order that they might get the trade; but when one Company would not increase their price, the others could not possibly do so. He mentioned this, because the rate that had been charged by them was 28c.; whereas had the agreement been carried out, it would have been 31c. The Chairman here read an extract from a report by the Manager, from which it appeared that "the old Company" who had the most advantageous position, "were not desirous of increasing the price." However, a telegram had been received from him to the effect that since June 1 he had been supplying gas at an increased price; so that he (the Chairman) had not the slightest doubt that the Companies had now come to their senses, and had agreed to ask the consumers to pay a higher figure. With reference to the consumption, this had been fairly satisfactory—the increase being about 9½ per cent.; while in the preceding year it was 7 per cent. The Directors were perfectly satisfied that the business was on a thoroughly sound footing; but it was the gold premium which affected them. As to the residual products, he said he had no doubt the shareholders would remember that, at the previous meeting, he explained that a very serious danger had arisen at their works from the sudden cessation of the demand for tar, and its accumulation on the works. With the view of preventing a repetition of this, the Directors ordered the erection of a tar-distilling apparatus; and he was pleased to say the business had been very satisfactory. In 1891 they only received for the tar made $4900; they could not get rid of it. In 1892, 230 tons of tar were used on the works. This, of course, made the residue no longer a drug on the market; and they were able to sell the refuse tar for $15,000. This was an enormous increase, and besides they were able to convert 230 tons of tar into oil and pitch, which brought in upwards of $8000. Last year another move was made, which, he believed, would eventually prove to be in the right direction. They resolved to send out plant for the production of ammonia. In 1893, they sold $14,000 worth of tar; they manufactured 1376 tons into various products, which realized $22,000; and they were able to make 6511 kilos. of liquid ammonia and 200 kilos. of anhydrous ammonia, which produced $7000. With tar, pitch, and ammonia, the Company were now doing well; but coke was falling in value. Taking, however, the whole of the residual products, they were distinctly satisfactory. In 1893, the total receipts from the bye-products was $169,229; while in 1892, only $158,289 was received—being an increase of $10,940, or nearly 7 per cent. If the price of coke had been maintained at the figure ruling in 1892, the receipts would have been $196,000, or an increase of 24 per cent. With reference to the accounts, they had a balance-sheet with, practically speaking, no creditors—the sundry creditors in London and Belgrano making a total of only £164. As to the profit and loss account, the shareholders would notice that there was a balance to the debit on Dec. 31, 1892. At the beginning of 1892, the Company were owing £13,928; but they were able to write off £4390 of that, because at that time the gold premium had fallen, and the liquid assets of the Company were more valuable than in the year before. They commenced 1892 with £9000 to the bad; and 1893, with £7000. It would be seen that the Directors had been able to write this down, so that they began 1894 with only a balance of £906 to make up. As to the capital expended in 1893, £2170 had been spent in the extension of mains; services for lighting various public buildings had cost £2328; and the ammonia plant, £1246. Additional land had also been purchased for the extension of the works, at a cost of £1812; and a new bed of retorts had been constructed, at an outlay of £1000. In conclusion, the Chairman moved the adoption of the report and accounts.

Mr. C. J. Hegan seconded the motion, which, after a few remarks from shareholders, was carried.

The retiring Directors (Messrs. Hegan and Hooper) and the Auditors were re-elected; and the usual acknowledgment of the services of the Directors concluded the proceedings.

BINGLEY IMPROVEMENT COMMISSIONERS' GAS SUPPLY.

The Results of the Past Year's Operations.

In the last issue of the Journal, there appeared a summary of the statement on the working of the Gas Department which Mr. Gatecliff submitted at a recent meeting of the Bingley Improvement Commissioners; and we are now able to supplement the particulars already given from a report of the remarks which were made by Mr. Gatecliff. Having called attention to the considerable increase in the quantity of gas made and sold, he stated that the residual products had not yielded so satisfactorily as in the previous year, owing to the bad coal and cannel which was received last summer. During the year they carbonized 7228 tons of coal and cannel, as against 6620 tons in 1892-3—an increase of 608 tons. In the maintenance account, there had been a considerable falling off in expenditure. For one thing, there had been no new mains laid; and they had been fortunate in being free from bursts, &c., and altogether the work had been very carefully dealt with. The management account was about the same. The average production of gas per ton of coal was 8936 cubic feet, as against 9072 feet; being a reduction of 136 feet. This was accounted for by the large amount of "bastard" cannel used. The number of meters showed a large increase; but there was very little addition to the rental. This was due to the large increase of cooking-stoves, for the meters connected with which they did not charge rent. In 1893 the number of cookers was 147; in 1894, 360; and that day, it had increased to 421. There was also a slight addition to the number of gas-engines. In the consumption of gas by the above, there had been a large increase—in value equal to £441. The total capital invested in cookers, meters, fittings, &c., up to March last was £2139. There were two objections raised to the policy the Committee had pursued in regard to cookers. One of them was that they had two prices for gas. He thought that that was a very poor objection, because they had three prices already. They allowed varying discounts according to the quantity of gas consumed; and this went to prove that the more gas they sold, the cheaper they could sell it. The second objection was that, if they could charge less for cooking purposes, they could charge the same amount for lighting. His answer to this was that, if they could double the consumption at once—raise it from 60 million cubic feet to 120 millions—and the consumption could be divided one-half during the day and one-half during the night, then they could charge one price all round. It might be said that, if they could not do it, how could they make a profit on the less charge? In reply, he gave them a simple illustration. Supposing that a certain number of consumers burned for lighting purposes 4 million cubic feet, and assuming that the profit was 2d. per 1000 cubic feet, this gave a total profit of £34. But if these same consumers were induced to burn 4 million cubic feet more for cooking purposes by the attraction of a reduced price (which perhaps only gave a profit of 1d. per 1000 feet), they would still be making a profit of £17 upon this part, and of £51 upon the whole transaction. It would be seen at once that their system was a good and sound one. He could assure the Commissioners of this, that, had it been otherwise, they would have had a serious loss this year, instead of a profit; and any hopes of a reduction would have been gone. They had a net income of some £600 or £700 from this item alone. They only charged 2½ per cent. for the rent of the cookers; and they had provided in addition for a sinking fund, interest, and maintenance fund. Referring to the results of the year's working, he said that the profit of £90 which they had made seemed a very small item; but it should not be forgotten that they had had £800 extra to pay for coals in consequence of the strike, and they had made a reduction of 2d. per 1000 cubic feet, which cost £250. For some years past, they had paid for all their extensions out of the reserve funds; and he thought that, on the whole, the works were in a very satisfactory condition. As to the estimate for the current year, he calculated the profit at £1000; and it would be his pleasure to advise the Committee to make a further reduction of 2d. per 1000 cubic feet next half year for gas consumed for illuminating purposes only. This would absorb £220, leaving £780, which, added to the present £455, would give a total reserve fund of £1235 at the end of the year. Mr. Gatecliff, in conclusion, spoke very highly of the abilities of the Gas Manager (Mr. G. D. Malam), who, he said, had done well for the ratepayers. A resolution was passed thanking Mr. Gatecliff and Mr. Malam for the information which they had supplied.

THAMES CONSERVANCY BILL.

As announced in the "Parliamentary Intelligence" in the JOURNAL for the 19th ult., the Select Committee of the House of Commons appointed to inquire into the proposals contained in the Thames Conservancy Bill have reported the measure, after having been occupied upon it for 28 days. Their report has since been printed. It is stated therein that, as directed by the instruction of the House on the 5th of April last, the Bill does not give any further powers to the Water Companies of taking water from the River Thames than might on that day be legally exercised. It is also stated that the preamble of the Bill has been amended in reference to the abstraction of water from the River Thames or its immediate neighbourhood.

At the meeting of the London County Council on the same day, the Special Committee appointed to consider matters affecting the Thames Conservancy presented a long report, which concluded with the following recommendations: "(1) That, in the opinion of the Council, the only method of providing adequate funds for the proper conservancy of the Thames is by means of a rate not exceeding ¼d. levied over the area of the Thames Valley within the jurisdiction of the Conservancy, provided such power of rating be given to a body of which not less than two-thirds are elected in proportion to the population of the Thames Valley. (2) That the Council is of opinion that the functions of the Board can be best carried out by statutory Committees, on which the presence of those specially interested in, and possessing special knowledge of, the work of the Committee might be provided. (3) That, in the opinion of the Council, the proposed constitution of the Board is wholly insufficient, and totally inadequate for the purposes of the Conservancy; and that the Members of Parliament for the various boroughs of London be therefore asked to oppose the Thames Conservancy Bill on the third reading, and to take such steps in reference thereto as may be necessary to give effect to the above resolutions." The recommendations were adopted with the alteration of the word "only" into "best" at the outset of the first one.

Last Wednesday, representatives of the Thames Conservancy and the County Councils of Middlesex, Surrey, Kent, Essex, Hertfordshire, and Wiltshire, had an interview with the President of the Board of Trade (Mr. Bryce), to urge the Government to oppose the motion of the Council for the recommital of the Bill. Mr. Littler, Q.C., stated that the Select Committee had fully considered the matter for 28 days, at an expense to the promoters of probably £25,000; and the recommitment of the Bill would mean that all this money would be wasted. Sir J. Dorington, M.P., Sir F. Nicholson, Mr. Maskelyne, Mr. Youll, and the Mayor of Reading also spoke. Mr. Bryce, in reply, said the Bill raised questions which were too large for a small Committee of the House of Commons; and it would have been desirable to have had a large one which could have considered the question of the constitution of the governing body detached to some extent from the minute matters with which the Committee dealt. It was a question whether one authority should govern the whole of the Thames Basin, dealing with the supply of drinking water to London and also with the navigation and everything concerning the Port of London. It was obvious that if the result of the inquiry which was to be made was to throw additional expense on the Board, the question would arise whether this expense should be met by shipping dues, to which there were obviously strong objections, or by a rate, and upon whom that rate should fall. At the same time, it would be a pity if all the expense incurred in promoting the Bill should be wasted this session; and all he could say as to the action of the Board of Trade when the Bill was brought forward in the House of Commons was that the matter should be most carefully considered.

In the House of Commons last Thursday, the Bill, as amended in Committee, came up for consideration. Mr. Stuart, who had the following notices on the paper: "That the Bill be recommitted to the former Committee," and "That it be an instruction to the Committee to add four additional members to the Board of Conservators as now proposed in the Bill—viz., two representing the Corporation of the City of London and two representing the London County Council; and, further, to make the constitution of the Board of Conservators, as amended, remain in force until Dec. 31, 1896, unless continued by Act of Parliament beyond that date or altered by Act of Parliament before that date," rose to move that the Bill be recommitted. Mr. Jackson (the Chairman of the Committee) raised a point of order as to whether the motion for recommittal and the proposed instruction could be taken together. The Speaker ruled that they could not. However, the breach of order was so slight, that he suggested that both the motion and the instruction should be put down for another day, and discussed "by order." This course was agreed to; and the matter is to be further considered on the 10th inst.

Reduction in the Price of Water Supplied by Meter in Liverpool.—A circular has been issued to consumers of water by meter in Liverpool and Bootle, informing them that the Corporation have decided to reduce the charges for water supplied during the next six months to the uniform rate of 6d. per 1000 gallons.

Extensions at the Windsor Water-Works.—An interesting ceremony took place at the Windsor Corporation Water-Works on Monday, the 18th ult., when the completion of a new well was celebrated by the turning on of the water by the Mayor (Mr. F. A. Layton), in the presence of the members of the Corporation. In the course of a short address, his Worship said that a great deal of credit was due to their Engineer (Mr. C. Sainty) for the excellent way in which he had carried out the work. When sinking the well, they were pumping water at the rate of 2000 gallons a minute; but that was not sufficient to keep the water under, and they had to have a second engine at work. This was satisfactory; and from the figures supplied to him by the Engineer, it was clear they would have a copious supply of water. Mr. Sainty also spoke—remarking that they had now all the water which would be required; and they could extend their mains to every street in the borough and in Eton and Clewer, and would not have to sink another well to supply them.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There is something of interest from Aberdeen this week. At a meeting of the Town Council on Monday, the Watching and Lighting Committee recommended that a new police building should be fitted up for electric lighting, at an estimated cost of £250; and that gas-pipes should be also put in, at an estimated cost of £98 10s., and fittings to the amount of £10—omitting the principal gas-fittings, which are estimated to cost a further sum of £100. This recommendation gave rise to objection by some of the councillors, who did not see the necessity for introducing gas at all. The objectors were, however, completely silenced by Bailie M'Kenzie, who said that Mr. Murray, the Electrical Engineer, had recommended that gas be introduced as well; that there was no house in Aberdeen where there were electric light fittings and no gas-fittings; and that this being a police office, they were bound to take the utmost precautions in connection with it. Notwithstanding these arguments, which cannot be answered, the subject was sent back to the Committee for reconsideration. It has been since reported that Mr. Murray denies having recommended the introduction of gas.

But a subject of greater importance was before the Gas Committee on Tuesday, when a report by Mr. A. Smith, the Gas Manager, upon experiments in the manufacture of oil gas which he has been making, was submitted. Mr. Smith, it was stated, found that, by using oil alone, he obtained a gas of 46-candle power; and that by using one ton of oil along with seven tons of splint coal, he obtained a gas of 24½-candle power. The cost, however, of producing this gas was found to be 1·7d. per 1000 cubic feet higher than from coal alone, which would amount to about £2580 per annum. The Committee decided that, so long as coal remains at its present price, and also considering that plant for oil gas would cost at least £5000, it would be unwise to proceed further with the experiments. The illuminating power of the gas at present was reported to be 21·23 candles. Now, it is not surprising that the Committee should have resolved to stop experiments. As I said once before, there is no harm in experiments being made, if there is any probability of anything useful being derived from them. But it is also open to remark that, in the present state of the oil-gas industry, experiments are almost out of date. I do not know Mr. Smith's process; but the results show that it is nowhere compared with the Peebles arrangement. By this system, it is well known, gas of an enriching value of 90 candles is obtained; and therefore, instead of requiring one ton of oil to seven tons of splint, half a ton would be amply sufficient. Besides, with oil gas of 90-candle power added to coal gas of 21-candle power, the result would be much more than 24½ candles; it would be over 30 candles. How would the price compare then? I venture to say there would be a saving by the use of oil, instead of a loss; and I know that Mr. Smith will be one of the first to admit this. The next three paragraphs bear on the same subject.

The annual report by the Directors of the Galashiels Gas Company was issued this week. They show a profit of £2104, out of which the customary dividend of 10 per cent. is to be paid, which will require £2100. The output of gas was: From coal, 42,407,700 cubic feet; and from oil, 9,817,600 cubic feet. There was a loss by leakage of 1,104,033 cubic feet; and 500,000 cubic feet were consumed in the works—leaving 50,621,267 cubic feet sold, which was a decrease upon the quantity sold in the preceding year of 8,128,131 cubic feet. The Directors add that they have now had twelve months' experience of the oil-gas process; and they have had much reason to be satisfied with it. The gas produced is much richer in quality and of greater illuminating power. During the past year the standard of 32 candles has been maintained; and, as fully anticipated by the Directors, there has been a considerable falling off in the consumption, due to the more permanent character of the gas. The consumption by private consumers—that is, exclusive of factories—has decreased by 4,106,732 cubic feet; there being thus a saving of this quantity to consumers. The total cost of the oil-gas plant was £1103, of which the Directors have charged against revenue £500; leaving £603 to be charged against capital, as representing the value of the addition to the works. The cost of coal was £3243; oil, £1096; and lime, £167. The price of gas is to be reduced from 3s. 6½d. to 3s. 4d. per 1000 cubic feet.

The annual report by the Hawick Gaslight Company has also been issued. The Directors state that they have entered into contracts for coal for the year upon favourable terms; and they recommend that the price of gas should be continued at 3s. 6½d. per 1000 cubic feet. They report an income of £7671 from the sale of 43,308,200 cubic feet of gas. They paid £4627 for 5348 tons of coal; and £198 for lime. The net profit is £1144. The dividend to be paid is not stated; but the accounts show that for the year ending at Whitsunday, 1893, the dividend absorbed £1573. There is a reserve fund of £3117, out of which the dividend may be made up.

It is interesting to compare the two Companies' results. In the case of Galashiels, the capital amounts to £21,000; and the value of the works is entered at £26,465. In Hawick, the share capital is £20,258; and the value of the works is given as £24,774. They are thus pretty nearly alike in these respects. There is a difference of over seven million cubic feet of gas sold; Galashiels being highest. In the case of Galashiels, coal and oil to produce the larger output of gas, of 32-candle power, cost £4339; in Hawick coal to produce the lesser quantity of gas, of 28 candles only, cost £4627. The revenue realized from residuals at Galashiels was £1009; and at Hawick, £773. Both Companies, it is to be observed, sold gas at 3s. 6½d. per 1000 cubic feet. Is there any explanation for the different results which have been obtained, except that at Galashiels the Peebles oil-gas process was in use, and that at Hawick it was not? The reduction in the price of gas at Galashiels to 3s. 4d., it is interesting to note, makes it equal to 1s. 8d. for 16-candle gas. It is also of interest to observe that in Galashiels the loss by leakage was only 2 per cent., which is sufficient testimony to the permanence of the oil gas.

The Edinburgh and Leith Gas Commissioners held their usual monthly meeting this week, at which a satisfactory increase of nearly 7½ million cubic feet in the output of gas during May, as compared with the same month of last year, was reported. Mr. Gibb laid his annual

accounts on the table; and they were sent to the Finance Committee to consider. Referring to them, Bailie Archibald said that, if matters continued as they had been, they might be able to reduce the price of gas by 4d. per 1000 cubic feet. This would make the price 3s. 2d., which would be the cheapest rate ever charged for gas in the city.

On Monday last, the foundation stone of the electric light works in Edinburgh was laid by Lord Provost Sir James Russell; and in connection with the occasion, Professor Kennedy, the Consulting Engineer to the Corporation, delivered a lecture in the evening upon the Edinburgh installation. In his remarks at the ceremony, Mr. Mackenzie, the Convener of the Electric Lighting Committee of the Corporation, said they had hoped to be able to turn on the current before the end of this year; but so many difficulties had to be overcome that he would not promise that now. One of these difficulties was the great number of cellars below the roadway which exist in Edinburgh. This difficulty, I am afraid, will, besides extending the time necessary for laying down the mains, send up the cost of the installation considerably, if the rule is to be observed that all wires outside houses must be underground, because of the great depth to which the wires must be taken.

It turns out that I was by no means alone in the views which I expressed last week regarding the appointment of Mr. David Wallace to be Gas Manager at Kelso. The annual meeting of shareholders of the Kelso Company was held on Wednesday, at which the subject was the principal topic of conversation. The customary business having been transacted (which included the declaration of a dividend at the rate of 10 per cent. for the year), a document was submitted regarding Mr. Wallace's appointment. A minority of the Directors had opposed the appointment, but had been over-ruled; and they then held a meeting of shareholders. It was the report of this meeting of shareholders which was laid before the meeting. It was stated that Mr. Wallace's application had been submitted to a firm of gas engineers who had always advised the Directors; and that their opinion was that the Directors should advertise for applications. This was accordingly done, and upwards of 40 were received. Notwithstanding that there were many who would have made good managers, the Directors, by a majority of one, elected Mr. Wallace, who, it appears, is an engineer who understands steam, water, and gas piping, and who once worked in a mill where gas was made on the premises. It had been suggested that he might learn the business of gas making in three months; and, further, that Mr. F. Scott, the present Manager, might be kept on for a little for the purpose of teaching him. How ridiculous all this sounds; yet it formed part of the procedure in the appointment. It was advanced, on behalf of Mr. Wallace, that he is a clever mechanic, and had been recommended by a firm of London engineers. His supporters also complained that they had not been invited to the meeting of shareholders, the report of which had been submitted to the annual meeting. After a good deal of discussion, the shareholders at the annual meeting, by a majority, adopted a resolution remitting to the Directors to cancel Mr. Wallace's appointment, and to secure the services of a practical man as manager. The Directors are thus placed in a peculiar position. I have no doubt they have intimated his appointment to Mr. Wallace; and consequently he may prefer to hold them to their contract. If he should, the resolution of the shareholders must either be set aside by the Directors, or the Company will have to compensate Mr. Wallace.

The strike of coal miners in Scotland is now in full swing. It is all but universal; and, indeed, is so general that picketing has been almost abandoned. There are two ways of looking at that. As is well known, had it not been for vigorous picketing, the strike would not have been so extensive. Therefore, while the leaders of the men congratulate themselves on being at the head of a solid phalanx, it is equally open to say that the withdrawal of the pickets may mean the return of a number of men to work, when, of course, the strike would collapse. The masters have this week declined to accept suggestions of conciliation measures being taken. The men's leaders, on the other hand, are loud in their protestations that they did not force on the strike, and that they are prepared to accept conciliation measures. It is too early yet to say anything as to the probable duration of the strike. On the men's side, nothing will be developed further until it be seen how much assistance comes to them from England. If it prove small, as so far appears likely, discontent will soon creep in among the men; and in a few weeks there may be a disposition to return to work. If this should turn out to be the case, there is every likelihood that the men will be prepared to resume work before the masters are willing to take them back; because in July the annual holidays at public works occur, and there is already a general feeling that the masters will not care to resume work until after these are over. This applies to iron and other large works, many of which are being closed on account of the advanced price of fuel. Those who have preferred to keep their works going are being supplied with abundance of fuel from England, at rates very little higher than recent quotations for home coal. There is thus almost a certainty that, however the men may hold out, there will be no cessation of the strike during July; and its duration after that will depend upon the support the men are able to command. It is a fortunate circumstance that gas-works are almost all supplied with coal sufficient to last nearly to September; so that there will be no immediate inconvenience to them.

The Dunfermline Gaslight Company held their annual meeting on Wednesday. Though, on account of dull trade and stoppage of mills, there was a decreased consumption of gas to the amount of ten million cubic feet, the profit on the year's working was satisfactory, and a dividend at the rate of 6 per cent. (the same as last year) was paid. This result, at a time when the Company are engaged in transferring their works to a new site, is very satisfactory indeed. A year ago it was reported that there had been an increase in the consumption of gas of three million cubic feet, so that the decrease during two years has been only seven millions. The new works are nearly ready for occupation. It is expected that they will be brought into use in about a fortnight from now, and that the old works will be altogether closed in the course of six months. It is thirteen years since the old Company began to prepare for the erection of new works. They then purchased ground outside the town, and erected a gasholder upon it. Two years ago, after the reconstruction of the Company, the Directors consulted Mr. T. Newbigging, of Manchester, as to the erection of new works. Mr. Newbigging's design for the works was accepted; and the Directors were about to let the contracts for the work when Mr. Mackenzie died. His successor, Mr. H. Pooley, has thus had charge of the whole of the work. The new works are reported to be excellent in every respect; but I have not seen them yet, though I intend to do so when once they are brought into use. They have been erected according to the plan which I described in this column in May of last year.

The Dundee Gas Commissioners held their annual excursion on Wednesday. They visited Pitlochry, and dined in Fisher's Hotel. The Water Commissioners of Glasgow made their annual inspection of the city water-works this week. The function is more of an excursion than an inspection, and lasts for three days; one of the nights being spent at Loch Katrine. It is on this excursion, and on the night of the Loch Katrine meeting, that the company informally agree upon who is to be the next Lord Provost.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 30.

Sulphate of Ammonia.—The market has remained without life during the greater part of the week; but towards the close, a little more activity is noticeable. Inquiries are more numerous; but there is so little sulphate to meet the demand that buyers will have to relinquish their low ideas, if they wish to make sure of supplies. The better inquiry before the month closes is indicative of large July requirements, when, in consequence of the small production (which has already passed out of makers' hands), we may see a considerable improvement in values. The effect of the strike in Scotland is not felt so far; but it cannot fail to make an impression upon the market, if the dispute lasts any time, and deliveries of sulphate are suspended in consequence. Sulphate is usually quite scarce enough at this time of the year; and the market cannot bear any curtailment in the supplies. There is practically no change in prices; £13 17s. 6d. being still quoted. Nitrate is steady at 9s. 6d.

LONDON, *June* 30.

Tar Products.—A strong demand has set in for carbolic acid; and a considerable business is doing. Pitch maintains its improved value; and business is reported at prices ranging, according to port of shipment, from 30s. to 32s. less the usual discount. Solvent naphtha is moving off freely at old rates, with an inclination to be dearer. Benzols are flat and unsaleable; and stocks in makers' hands are said to be large. There is more inquiry for creosote and other tar oils; and as the make is now largely diminished, it is expected to sell more freely, at better prices, though distillers hold large stocks. There is no news about anthracene; but the Committee's price is firmly held. Prices are as follows: Tar, 13s. 6d. to 18s. 6d. Pitch, 30s. to 32s., according to port. Benzol, 90's, 1s.; 50's, 1s. 3d. Solvent naphtha, 1s. 4d. Creosote, 1¾d. Creosote salts, 20s. Toluol, 1s. 6d. Cresylic acid, 1s. Crude benzol naphtha, 30 per cent., 5d. Carbolic acid, 60's, 1s. 8d. Anthracene, "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia is recovering, thanks largely to the prospect of a much shorter supply, owing to the coal strike in Scotland. The make of sulphate of ammonia from the blast-furnace gases is a considerable one; and the cessation of production in this direction must have an important influence on the market. Business during the week has been done, according to position and conditions of sale, at prices ranging between £13 17s. 6d. and £14, less 3¼ per cent. Gas liquor is quoted at 11s. to 13s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The increased shipping demand which has come forward in this district, as a result of the miners' strike in Scotland, is helping to take away some of the surplus supplies in the commoner qualities of round coal; but there is no really material improvement in the market. Supplies continue largely in excess of requirements; and although official list rates remain unchanged, sellers, to effect clearance sales of stocks under load, are willing to take very low figures, while there is a continued very keen competition to secure business of any weight. With regard to the gas-coal contracts, these are gradually being settled; but, except for comparatively small quantities, no really appreciable advance upon last year's low rates has been had. This is owing largely to the competition of coal which has been offered from outside districts; Staffordshire colliery owners having quoted extremely low figures to get hold of contracts. One Staffordshire firm has secured about 80,000 tons of the Birmingham gas coal contracts at a very low figure; while they have also secured a small portion of the supply of the Manchester Corporation. In some of the smaller contracts, 6d. to 9d. over last year's prices has been obtained; but it is exceptional where more than about 3d. above last year's rates has been obtainable on contracts of any great weight. So far as the demand for other descriptions of round coal is concerned, the better qualities are now only in the most limited request for house-fire purposes. Best Wigan Arley is quoted at 11s. to 11s. 6d.; Pemberton four-feet and seconds Arley, 10s. to 10s. 6d.; and common house coals, at about 8s. to 8s. 6d. per ton at the pit mouth. There are, however, sellers in the market who would readily book orders at under these figures. Common coals also meet with but very slow inland sale; and about 7s. to 7s. 6d. represents the full average figures for good ordinary qualities. Engine classes of fuel become more and more plentiful in the market, especially the commoner sorts. The lower qualities of slack are offering freely at about 4s. 3d. to 4s. 6d.; and better sorts, 5s. to 5s. 6d., with some of the special qualities quoted at 6s. to 6s. 6d. per ton at the pit mouth.

Northern Coal Trade.—The Northern coal trade is now irregular in position and uncertain, though higher, in price. In consequence

of the Scotch coal strike, collieries here are now working fuller than they were; and the prices at which coal is sold are perceptibly higher. Best Northumbrian steam coals are quoted at about 11s. to 12s. 6d.; second-class steam, 10s. to 10s. 6d.; and steam smalls, from 4s. 9d. to 5s. 9d. per ton f.o.b. There is now a good demand, though, of course, it includes much coal sold on old contracts at prices 1s. to 1s. 3d. per ton below those just named. Gas coal is also plentiful; but some coalowners now ask more than was the general price last week—7s. 6d. to 8s. being the quoted rate. Deliveries of gas coal are now increasing to many places; so that it would seem that shippers and contractors desire to take advantage of a range of steamship freights that are low almost beyond precedent, and that must be unprofitable to the shipowner. Manufacturing coals are steady. Coke is firmer, with an increased inquiry both for export and for local use. Some of the producers have advanced the prices; and from 13s. 6d. to 15s. per ton f.o.b. may now be quoted as the current rate, and one that finds buyers. There is no alteration in the position or price of gas coke; but the shipments are larger, and it may be dearer should the Scotch strike continue long.

Scotch Coal Trade.—The home trade is, of course, at a complete standstill; but plenty of coal is being received from England. Lancashire coal is being offered at 14s. 6d., and Durham coal at 19s. per ton delivered. Lancashire steam coal is also offered f.o.b. in Mersey ports at 8s. 9d. to 9s. The shipments for the week are down, having been 154,361 tons—a decrease of 7781 tons as compared with the preceding week, but an increase of 10,787 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 3,517,587 tons—an increase upon the quantity for the same period of last year of 367,762 tons.

Reduction in the Price of Gas at Shrewsbury.—The Directors of the Shrewsbury Gas Company have reduced the price of gas 3d. per 1000 cubic feet; bringing it down to 3s. 3d. within, and 3s. 6d. beyond the borough.

Extensions at the Calverley and Horsforth Gas-Works.—Under the advice of their Consulting Engineer (Mr. J. Wilkinson), alterations are being carried out in the arrangement and working of the manufacturing plant of the Calverley and Horsforth Gas Company. Two new tower scrubbers, 9 feet in diameter and 36 feet high, filled with boards, are also being erected. Messrs. R. Dempster and Sons, Limited, of Elland, have secured the contract; and they are also supplying one of their tar and liquor separators.

The Bath Question in South London.—Last Thursday, a motion in the action of *The Attorney-General v. Vestry of Camberwell* came before Mr. Justice Chitty (sitting for Mr. Justice North) in the Chancery Division of the High Court of Justice; but, by consent, it was arranged that it should stand over for a month, on the understanding that the defendants should not in the meantime contribute, out of the general or other rates, towards the costs incurred, or to be incurred, in obtaining a declaration of law as to the right of the Lambeth Water Company to make a charge for water supplied to baths.

Carrickfergus Gas Company, Limited.—The fortieth annual general meeting of this Company was held on the 20th ult., when the Directors reported a profit of £44 on the working in the twelve months ending April 30 last. The amount would have been larger had not considerable expenditure been incurred on the works. The sum available for division was £60; and a dividend of 3 per cent. was recommended. To pay this, £29 had to be taken from the invested reserve. Mr. R. Green, the former Manager, having resigned his position, Mr. A. Todd, of Limavady, was unanimously appointed as his successor. The change of managership afforded the Directors an opportunity of revising the property accounts; and £261 had been written off the meter and £148 off the buildings account, and the sums thus deducted charged to the invested reserve. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 31.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p. c	10	12—13	..	5 15 4
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	108—110	..	4 10 11
100,000	20	14 June	8	Bahia, Limited	20	9½—10½	..	15 3 10
200,000	5	11 May	6½	Bombay, Limited	5	5½—5¾	..	5 13 0
40,000	5	,,	6½	Do. New	4	4—4¼	..	5 15 6
980,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	223—228	..	5 0 10
180,000	,,	,,	8½	Do. New	100	168—173	..	4 18 3
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	110—113	..	4 8 6
320,000	20	29 Mar.	11½	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16—17	..	5 0 0
328,750	10	28 June	2	Buenos Ayres (New) Limited	10	5½—6*	..	3 6 8
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	101—104	+½	5 15 5
150,000	20	23 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	257—262	..	4 15 5
165,000	,,	,,	9½	Do. New do.	100	190—195	..	4 17 5
160,762	,,	14 June	4½	Do. 4½ p. c. Deb. do.	100	130—135	..	3 6 8
800,000	Stck.	14 June	13	Continental Union Limited	100	235—240	..	5 8 4
200,000	,,	,,	10	Do. 7 p. c. Pref	100	210—215	+5	4 13 0
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	..	4 10 11
486,090	10	31 Jan.	11†	European, Limited	10	23½—24½	..	4 9 10
354,060	10	,,	11†	Do. Partly paid	7½	16½—17½	+½	4 14 3
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	237—242	+5½	4 19 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—104	..	3 16 11
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	177—182	..	3 16 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—172	..	3 9 9
1,061,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	11 May	12	Imperial Continental	100	214—219	+1	5 9 7
75,000	5	14 June	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	14 June	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 May	8	Oriental, Limited	5	5¾—6¼	..	6 8 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	..	10 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 June	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	320—325	+3	4 15 4
1,350,000	,,	,,	12	Do. B do.	100	265—270	+2	4 8 11
260,000	,,	,,	13	Do. C do.	100	273—277	+2½	4 13 10
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	153—157	..	3 3 8
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
746,011	Stck.	28 June	10	Chelsea, Ordinary	100	275-280*	+3	3 11 5
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	225—230	..	3 9 7
544,440	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	145-148*	..	3 0 9
700,000	50	14 June	8½	Grand Junction	50	118—122	+2	3 9 8
708,000	Stck.	28 Feb.	11½	Kent	100	295—300	..	3 16 8
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	253-258*	..	3 13 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	203-206*	+½	3 12 9
330,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	367—372	..	3 5 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	134—137	..	2 18 4
902,300	Stck.	14 June	6	S'thwk & V'xhall, 10p. c. max.	100	163—168	..	3 11 5
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—150	..	4 0 0
1,155,066	Stck.	14 June	10	West Middlesex	100	267--272	..	3 13 7

*Ex div.

† Next dividend will be at this rate.

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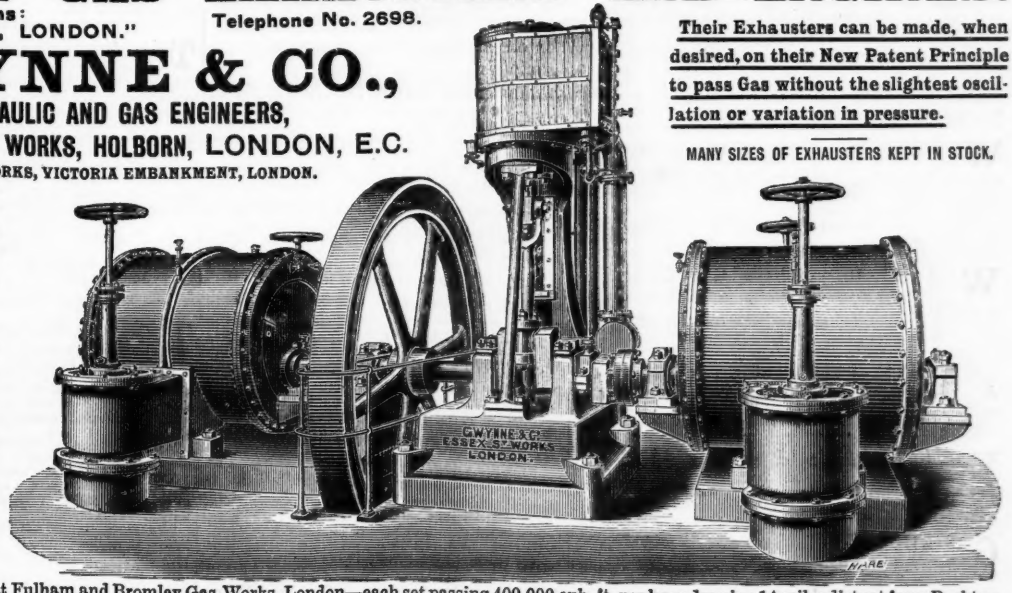


Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 1147.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers, BIRMINGHAM, LEEDS, and WAKEFIELD.

FOREMAN Main-Layer wants a Job or PERMANENCY, or would go abroad. Has been abroad before. First-class testimonials.
Address L. SCOTT, West Street, Shoreham, SUSSEX.

THE Assistant Engineer of two large Gas-Works on the Continent, making 900 million cubic feet per annum, is OPEN TO AN ENGAGEMENT. Speaks three languages.
Address No. 2406, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED a Situation as first or second STOKER in a Gas-Works. Several years' experience, and first-class reference. Total Abstainer. Scotland or the North of Ireland preferred.
Address, stating wages, No. 2405, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS COAL AND CANNEL.

A GENTLEMAN (at present Manager of a well-known Firm in London of Gas Cannel and Steam Coal Merchants and Exporters), with a large and valuable connection among Gas-Works and the principal buyers at home and abroad, desires a SIMILAR POSITION with an established and first-class House already engaged in this business, or willing to add such a department to their existing Coal or Colliery Business.
Please reply to No. 2401, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Vienna Firm, having a large connection, the AGENCY (or the Sale on Commission) of MANUFACTORIES of GAS and WATER SUPPLY ARTICLES, of STEAM ARMATURES, and similar Goods.
Address offers to B.L. 1470, care of Mr. Otto Maass, VIENNA, I. (AUSTRIA).

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 2390, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE — The Plant of a Small Gas- Works, producing 2 millions annually. Storeage capacity, 8300 feet. Production discontinued.
Apply to Mr. J. MILLS, Old Windsor, BERKS.

FOR SALE—A Cast-Iron Tank, 65 feet diameter and 12 feet deep, in good condition, suitable for Gasholder, or Tar or Liquor Tank.
Apply to CONTRACTOR, 158, Walton Street, OXFORD.

GAS-ENGINE (9-Horse Power "Otto"), nearly new, included in AUCTION OF WOOD WORKING MACHINERY, &c., on July 12 at 1 and 2, Steward Street, Bishopsgate.
Catalogues of EASTMAN BROS., Auctioneers, 23, BUCKLERSBURY, E.C.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 6 of this Week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

FOR SALE, very cheap—Two Circular CAST-IRON TANKS, 7 feet diameter by 4 ft. 6 in. deep.
Address No. 2403, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AMMONIA SATURATORS.

TO GAS ENGINEERS, SULPHATE OF AMMONIA MANUFACTURERS, ETC.

MESSRS. W. THOMASON AND SONS, Chemical Plumbers, Lead Burners, &c., 21, WESTON STREET, BOLTON, beg to call the attention of Gas Engineers and others to the fact that, having laid down New Plant of the most modern construction, they have now the most complete and best adapted Premises in Lancashire for the Manufacture of LEAD SATURATORS and all kinds of CHEMICAL PLUMBING, and will be pleased TO QUOTE for any kind of LEAD WORK or REPAIRS of any description. By employing first-class Chemical Plumbers only, they can guarantee to give satisfaction to any orders entrusted to them.
Messrs. W. THOMASON AND SONS have on hand, ready for delivery, a Solid Plate Lead Saturator, 5 ft. by 4 ft. by 4 ft., made from 1-inch Lead Plates for the sides and midfeather, and 1¼-inch Lead Plates for the top and bottom, burned solidly together by an improved process; and they invite inspection of the same by Gas Engineers or others interested.
Please write for an Estimate before ordering elsewhere. Lead Burners sent out to repairs.

WEST MALLING GAS COMPANY.

TENDERS FOR GAS COAL.

TENDERS are invited for the supply of about 550 tons (more or less) of PELTON MAIN or any other class of really good GAS COAL, to be delivered at the Company's Works, West Malling, between the 29th of September, 1894, and the 29th of September, 1895, in quantities of not more than 60 tons a month.
The name and quality of the Coal to be specified in the tender.
Sealed tenders, endorsed "Tenders for Coal," to be forwarded to me on or before the 16th of July next.
The Directors do not pledge themselves to accept the lowest or any tender.

By order,
HENRY D. WILDES,
Secretary.

West Malling, June 18, 1894.

BOROUGH OF DONCASTER.

TENDERS FOR COALS.

THE Gas Committee of the Borough of Doncaster are prepared to receive TENDERS for the supply of 12,000 tons of best GAS COALS, during a period commencing July, 1894, and terminating June 30, 1895.
Particulars and Tender Forms may be obtained on application to John Athron, Esq., Chairman, or to the undersigned.
Tenders should be sent under seal, to the Chairman, endorsed "Tender for Coals," not later than Ten a.m., on Wednesday, the 11th of July next.
By order of the Gas Committee, who do not bind themselves to accept the lowest or any tender,

R. BRIDGE,
Engineer.

Gas-Works, Doncaster,
June 27, 1894.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality, Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 1254.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HAWORTH LOCAL BOARD OF HEALTH.

TENDERS invited for the purchase of the Board's surplus TAR and LIQUOR for the Year ending June 30, 1895, delivered on Rails at Haworth Station.
Tenders to be sent to me not later than July 12.

WM. ROBERTSHAW,
Clerk.

5, Temple Street, Keighley.

TO BOILER MAKERS.

THE Gas Committee of the Hereford Corporation are prepared to receive TENDERS for the construction, providing, and fixing of a LANCASHIRE STEAM-BOILER.
The Specification may be seen and the Drawing and Site inspected from the 3rd to the 10th of July, on application to the undersigned.
The Committee do not bind themselves to accept the lowest or any tender.
Tenders, endorsed "Tender for Boiler," to be sent in, addressed to the Chairman, Gas Committee, Mansion House, Hereford, by Saturday, the 21st of July, 1894.

By order,
WILLIAM PARLBY,
Gas Engineer and Manager.

Gas-Works, Hereford,
June 29, 1894.

CITY OF HEREFORD.

THE Gas Management Committee of the Corporation invite TENDERS for the supply of best screened large GAS COAL for One Year, from the 1st of August next, to be delivered free at the Gas-Works Siding, Hereford, in such quantities as may be required from time to time.
The estimated quantity required will be about 8000 tons.
Full Particulars and printed Forms of Tender may be obtained on application to the undersigned.
Tenders, endorsed "Tender for Gas Coal," are to be sent in, addressed to the Chairman, Gas Management Committee, Mansion House, Hereford, by Saturday, July 7.
The Committee do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM PARLBY,
Gas Engineer and Manager.

Gas-Works, Hereford,
June 18, 1894.

YSTRAD GAS AND WATER COMPANY.

THE Directors of the above Company invite TENDERS for the surplus TAR produced at their Gas-Works at Ystrad and Porth, Rhondda Valley, during the Twelve Months ending July 31, 1895.

Tenders to be sent to the Secretary's Office not later than Monday, the 23rd day of July inst., marked "Tar."

ARTHUR P. JAMES,
Secretary.

123, Queen Street, Cardiff.

COLNE LOCAL BOARD.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of from 7000 to 9000 tons of GAS COALS during the next Twelve Months.

Forms of Tender and any further Information can be obtained from the undersigned, to whom tenders must be sent on or before the 7th of July, 1894.

HY. SIMMONDS,
Engineer and Manager.

Gas-Works, Colne,
June 19, 1894.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are prepared to receive TENDERS for the supply of about 78,000 tons of CANNEL and COAL required by them during the Year ending the 30th of June, 1895.

Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Saturday, the 7th of July, 1894.

A. NICHOLSON,
Town Clerk.

Oldham, June 27, 1894.

OSWALDTWISTLE LOCAL BOARD.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1894.

The quantity of coal carbonized is about 3500 tons.

Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.

Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 25th of July.

WM. SANDEMAN,
Clerk.

Local Board Offices, Oswaldtwistle,
June 30, 1894.

NORTHWICH GAS COMPANY.

TENDERS are invited for the supply and delivery at Northwich Railway Station of about 3300 tons of GAS COAL and 200 tons of CANNEL during the ensuing Twelve Months.

TENDERS are also invited for the supply and delivery of LIME and SULPHURIC ACID during the same period.

Any further Particulars required may be had on application to Mr. S. S. Mellor, Manager.

Tenders, endorsed and addressed to the Chairman, must be delivered here not later than the 6th of July next.

HY. PICKERING,
Secretary.

Gas-Works, Northwich,
June 21, 1894.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the supply of GAS COAL or NUTS for a period of Eight Months, commencing on the 1st of November next.

The quantity required is 6000 tons.

Specification, with Tender Form and all Particulars, may be had from the undersigned.

Sealed tenders, endorsed "Coal," and addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leigh, not later than Monday, the 16th inst.

The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
July 2, 1894.

BRIDGNORTH CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee hereby invite sealed TENDERS for the supply of GAS COAL (including Carriage to the Bridgnorth Railway Station) for One Year from the end of August next.

Evidence as to the quality of the Coal must accompany each tender.

Quantity required about 1600 tons in proportionate deliveries as directed—say, 70 per cent. during Winter Months, and 30 per cent. during Summer Months.

Sealed and marked tenders must be sent to the undersigned not later than Monday, the 9th day of July.

The Committee do not bind themselves to accept the lowest or any tender.

J. H. COOKSEY, Town Clerk,
Secretary.

Bridgnorth, June 25, 1894.

HORSHAM GAS COMPANY, LIMITED.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Horsham Gas Com- pany are prepared to receive TENDERS for the purchase of the surplus TAR and LIQUOR produced at their Works, f.o.r. Horsham Station, in Purchaser's own Casks, for One Year from the 1st of July, 1894.

The Liquor to be 5° Twaddel.

Terms: Cash, Quarterly.

Further Particulars can be obtained on application to the undersigned.

Tenders to be delivered at this Office by the 7th of July.

The Directors do not bind themselves to accept the highest or any tender.

E. D. SAPEY,
Manager.

Gas Offices, Horsham,
June 26, 1894.

THE WALLINGFORD GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Wallingford Gaslight and Coke Company, Limited, invite TENDERS for the supply for One Year, from the 13th of August next, of about 900 tons of best screened GAS COAL, to be delivered free, at the Railway Station at Wallingford, in such quantities and at such times as the Company may require.

Payments monthly.

Sealed tenders, endorsed "Tender for Gas Coal," to be delivered on or before the 31st of July next.

The Company do not bind themselves to accept the lowest or any tender.

By order,
JOHN CARTHEW,
Secretary.

Wallingford, June 23, 1894.

By order of the Administrators of the late Dr. J. Brickwell, the Directors of the Waltham Abbey and Cheshunt Gas Company, and others.—Important Sale of Gas and Water Stocks and Shares.

MR. ALFRED RICHARDS will sell by AUCTION, at the Mart, E.C., on Monday, July 9, 1894, at One for Two o'clock precisely, in lots, STOCKS and SHARES in the following Undertakings:—

Tottenham and Edmonton Gaslight and Coke Company.
Lea Bridge District Gas Company.
Waltham Abbey and Cheshunt Gas and Coke Company.
Ascot District Gas Company.
Romford Gas and Coke Company, Limited, and the South-West Suburban Water Company.

Particulars of E. K. ROBINSON, Esq., Solicitor, 14, Hart Street, BLOOMSBURY SQUARE, W.C.; of HUBERT GOUGH, Esq., Secretary, Waltham Abbey and Cheshunt Gas Company, WALTHAM ABBEY; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C., and 816, High Road, TOTTENHAM.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

LONDON:

WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,

(Established 1851,)

Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.

Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, Ipswich Gaslight Company, Devonport Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

CURLEY CANNEL.

Mr. JOHN METHVEN, Gas Engineer of The Gaslight and Coke Company, Beckton, has tested this famous Cannel, and says:

"The above results indisputably place this Cannel at the *head of the list* of the most valuable Cannel raised in this Kingdom."

Particulars, Analysis, and Prices to be had on application to

S. CHANDLER & SONS, PONTYBODKIN, NORTH WALES.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.

London Office:
90, CANNON STREET, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD
CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL,

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21 JOHN STREET, ADELPHI, LONDON, W.C.

HUNTER'S
OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LOW MOOR BLACK BED GAS COAL.

YIELD OF GAS PER TON	10,375 CUBIC FEET.
ILLUMINATING POWER	17·50 SPERM CANDLES.
COKE	75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

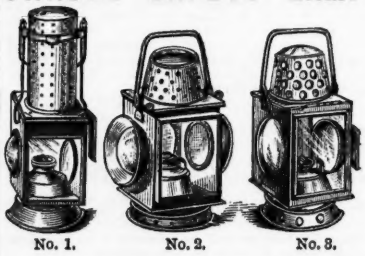
Just published.
With numerous Illustrations and Tables, crown 8vo. cloth, 6s.

THE
GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.
Honours Medallist in Gas Manufacture, City and Guilds of London Institute.

LONDON: E. & F. N. SPON, 125, Strand.
NEW YORK: 12, Cortlandt Street.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.



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48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
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JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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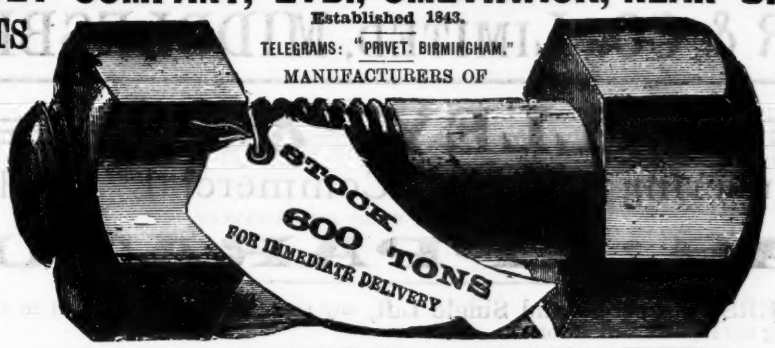
ENGINES,
BOILERS,
&c., &c.



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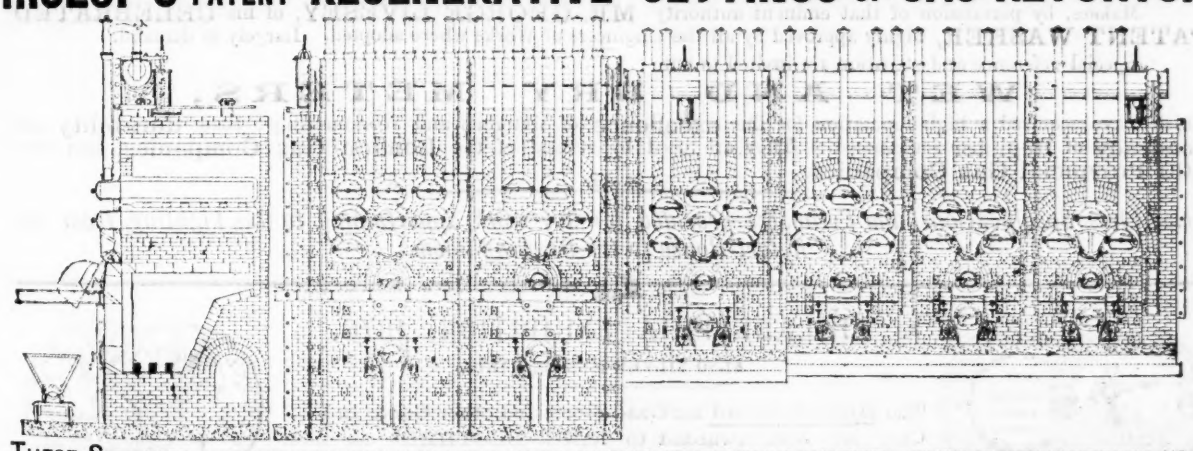
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS, AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings; or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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Specially prepared Benzole for fortifying Gas, 10d. (tenpence) per gallon f.o.r. in Tank-Trucks, or in Casks One Penny per Gallon extra.

Costs only One-Third of a Penny per Candle.

One Gallon of Benzole is equal to Three Gallons of Petroleum Spirit for Carburetting Gas.

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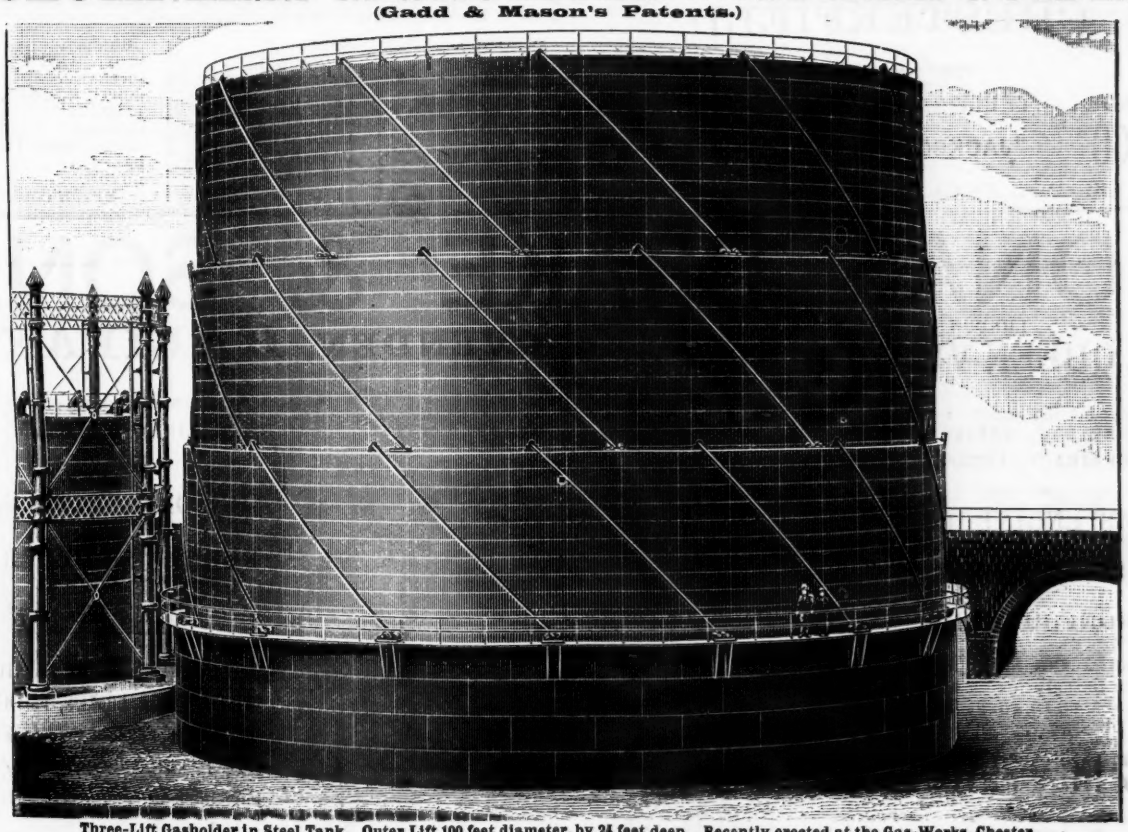

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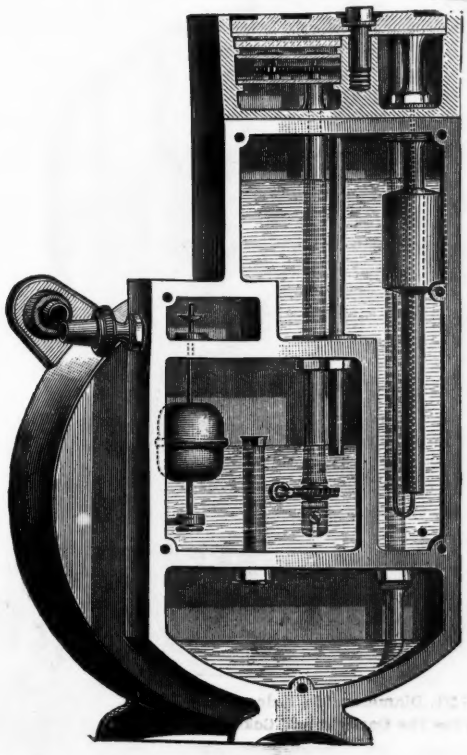

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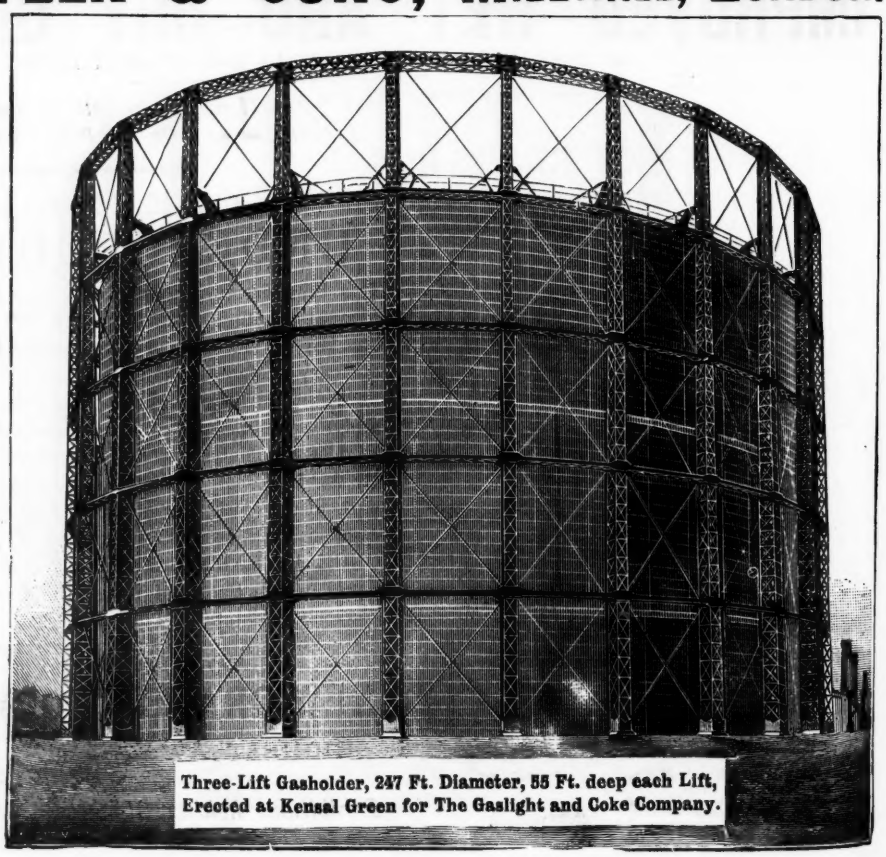

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Constructed on a **PRINCIPLE** which has **PROVED MOST EFFICIENT**, and **NOT REQUIRED IMPROVING**, giving the **LARGEST AMOUNT OF FRESHLY WETTED SURFACE** of any machine yet introduced.

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